Appendix A

REFERENCES

(Boyle, 2004) Boyle Engineering, *Northwest Quadrant Recycled Water Study* – prepared for Olivenhain Municipal Water District, June 2004.

(CDM, 1993) Camp Dresser and McKee, Inc., *Vista Irrigation District Water Reclamation Master Plan*, November 1993.

(CDM, 1997) Camp Dresser and McKee, Inc., *North County Water Reclamation Project Phase II Master Plan*, April 1997.

(CDPH, 2008) California Department of Public Health, *Draft Groundwater Recharge Reuse Regulations,* August 2008.

(CDPH, 2009a) California Department of Public Health, http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Waterrecycling.aspx, Accessed 2009.

(CDPH, 2009b) California Department of Public Health, http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook.aspx, Accessed 2009.

(CPC, 2007) California Plumbing Code, *Chapter 6 Water Supply and Distribution*, 2007.

(Carlsbad, 2004) Carlsbad Municipal Water District (CMWD). *Phase II Recycled Water Project Implementation Plan.* April 2004.

(Carlsbad, 2008) City of Carlsbad. *Mahr Reservoir Improvements: Operations and Maintenance Manual.* 23 October 2008.

(CMWD, 2000) Carlsbad Municipal Water District. *Recycled Water Program Expansion.* 2000.

(CMWD, 2008) Carlsbad Municipal Water District, *Engineering Standards, Volume II Potable and Recycled Water Standards,* Revised 30 June 2008. [Available in Appendix G]

(CMWD, 2005) Carlsbad Municipal Water District (CMWD). *2005 Urban Water Management Plan*. Approved 13 December 2005.

(CMWD, 2005b) Carlsbad Municipal Water District (CMWD). *Ordinance 43.* "An Ordinance of the Board of Directors of Carlsbad Municipal Water District (CMWD), Carlsbad, California, Mandating Use of Recycled Water and Rescinding Ordinance No.31". Adopted 21 June 2005. [Available in Appendix E]

(CMWD/EWA, 2005) Carlsbad Municipal Water District and Encina Wastewater Authority. *Memorandum of Understanding for the Operation and Maintenance of the Carlsbad Municipal Water District Water Recycling Facility*. May 1, 2005.

(CMWD, 2006) Carlsbad Municipal Water District (CMWD). *Lake Calavera Annual Management and Daily Operations Plan.* March 2006.

(CMWD, 2010) Carlsbad Municipal Water District (CMWD). *Historical Seasonal Recycled Water Use*. Spreadsheet of monthly demands for January 1993 to December 2009. Received January 2010.

(CMWD, 2011) Carlsbad Municipal Water District (CMWD). *Reclaimed Water Development Fund*. Annual reports of monthly recycled water supply and demand for FY0203, FY0506, FY0607, FY0708, FY0809, and calendar year 2010. Received 1 September 2009 and 23 March 2011.

(CMWD/LCWD, 1991) Carlsbad Municipal Water District and Leucadia County Water District. *Agreement for Sale of Recycled Water to the City of Carlsbad by the Leucadia County Water District.* Revised 7 March 1991.

(Carollo, 1997) Carollo Engineers. *Carlsbad Municipal Water District: Master Plan Update Volume IV: Reclaimed Water*, October 1997.

(CGvL, 2003) Cathcart, Garcia, von Langen (CGvL). *Mahr Reservoir Remedial Improvements: Draft 30 Percent Design Report.* October 2003.

(Dudek, 2003) Dudek and Associates, Inc. *City of Carlsbad Sewer Master Plan Update.* March 2003.

(DEH, 2001) County of San Diego Department of Environmental Health, *Recycled Water Plan Check and Inspection Manual,* 2001 Edition.

(EJPA, 2009) Encina Joint Powers Authority. *Daily Flow Monitoring, Monthly Monitoring Report, Quarterly Monitoring Report, and Annual Effluent Monitoring.* Meadowlark WRF (1998 to 2009), Carlsbad WRF (2005 to 2009), and Gafner WRP (2008 and 2009, for Gafner, only Quarterly and Annual Reports). Spreadsheet format. Received October 2009.

(JPA, 2000) John Powell and Associates, Inc. (JPA). *Encina Basin Recycled Water Distribution System Study.* CMWD No. 98-301. May 2000.

(KJ, 2005) Kennedy/Jenks Consultants (KJ). *Vallecitos Water District 2002 Water, Wastewater, and Water Reclamation Master Plan Update.* June 2005.

(MWDSC) Metropolitan Water District of Southern California (MWDSC). *Encina Basin Water Reclamation Projects Phase I and II.*

(MWH, 2001) Montgomery Watson Harza (MWH). *Carlsbad Water Recycling Facility Influent Pumping and Equalization Preliminary Design Report.* September 2004.

(RWQCB, 1993) Regional Water Quality Control Board – San Diego Region, Addendum No. 1 to *Order No. 93-23,* Vallecitos Water District – Meadowlark Water Reclamation Plant, 1993.

(RWQCB, 2001) Regional Water Quality Control Board – San Diego Region, *Order No. 2001-352,* Master Reclamation Permit with Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District – Carlsbad Water Recycling Facility, 2001.

(RWQCB, 2004) Regional Water Quality Control Board – San Diego Region, *Order No. R9-2004-0223,* Waste Discharge Requirements for Leucadia Wastewater District – Forest R. Gafner Water Reclamation Plant, 2004.

(SWRCB, 2009) State Water Resources Control Board. *Recycled Water Policy.* Resolution Number 2009-0011. Approved 14 May 2009.

(SWRCB, 2010) State Water Resources Control Board. *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water: Recommendations of a Science Advisory Panel.* Final Report. 25 June 2010.

(USGS, 2010) United States Geological Society, "National Elevation Dataset 1/3 arc second for USGS Quad N34W118". August 2010. [http://gisdata.usgs .gov/webappcontent/neddownloadtool/NEDDownloadToolDMS.html].

(VWD/CMWD, 2003) Carlsbad Municipal Water District and Vallecitos Water District. *Agreement for Sale of Recycled Water and Use of Mahr Reservoir Between the Vallecitos Water District and the Carlsbad Municipal Water District*. 20 August 2003.

(VWD/CMWD, 2004) Carlsbad Municipal Water District and Vallecitos Water District. *Agreement Between the City of Carlsbad, Carlsbad Municipal Water District, and the Vallecitos Water District for the Construction and Reconstruction of Recycled Water Lines and Related Structures, Rancho Santa Fe Road North, Phase 1, Project Nos. 3190 and 3887*. 19 February 2004.

(WRCC, 2010) Western Regional Climate Center, "Monthly Climate Summary for Oceanside Marina, California (Station Number 046377)". Period of Record 1 October 2009 through 13 December 2010. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6377, Accessed 23 April 2010.

References: GIS Layers			
Layer Name [Original Filename]	**Description**	**Date Modified (or Received)**	**Source**
Streets-Centerlines.shp [CB_All_Roads]	Street centerlines	8/3/2009	City
Elev-Contour-2_ft-2005.shp [CB_Contour2005_2FT]	2-foot elevation contours (polyline)	2005	City
Boundary-City.shp [CB_MUNICIPAL_BOUNDARY]	City boundary	8/3/2009	City
Parcels.shp [CB_Parcels_SanGIS]	Parcels within City	8/3/2009	City
Planning-Zoning.shp [CB_PLANNING_ZONING]	Zoning within City	8/3/2009	City
Boundary-Water_Districts.shp [CB_Water_Districts]	Water Retailer Jurisdictional Boundaries within City	8/3/2009	City
Boundary-Sewer_Districts.shp [CB_Sewer_Districts]	Sewer Agency Jurisdictional Boundaries within City	8/3/2009	City
CB_WaterBodies	Bodies of water within City	8/3/2009	City
dem2005	Digital elevation model	2005	City
Planning-Land_Use.shp [LandUse_2008_SanDAG]	Land use designations within City	2008	City
USGS_RiverStream	Bodies of water within City	8/3/2009	City
Parcel-CA-San_Diego-Carlsbad_Region.shp	Parcels for areas outside City	2007	SanGIS
Aerial-1_ft-2008.sid	Aerial photograph of City	2008	City
Carlsbad_Meters_carollo_9_1_09.shp	CMWD water meters	9/1/2009	City
Carlsbad_Mains_Carollo_9_15_09.shp	CMWD pipelines	9/15/2009	City
DevelopableLand.shp	Potential new developments	6/14/2010	City [SANDAG]
Subdivision.shp	Housing subdivisions within San Diego County	October 2009	SanGIS
Elev_NED_N34W118.tif (USGS, 2010)	1/3 arc second NED Raster for USGS Quad N34W118	8/12/2010	USGS

CARLSBAD SUPPLY ALTERNATIVE COST ESTIMATES

This appendix includes cost estimates developed for the relevant treatment facilities evaluated in this study. This appendix consists of two parts.

- Part 1 consists of the treatment cost estimates developed for the supply alternatives in Chapter 4 (based on build-out demands).
- Part 2 consists of the treatment cost estimates for the two phases of expansion included in the CIP described in Chapters 9 and 10

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures.

Carollo Engineers has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Appendix B – Part 1

Carlsbad Supply Costs

May 2011 ENR **9035**

Location Factor (Carlsbad) 1.040

Alternative 1 - 6.25 mgd Carlsbad WRF Expansion

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	$754,500
10	TERTIARY FILTERS	7.5-mgd (1600 ft^2)	$1,054,555	6.3-mgd	$1,397,750
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	6.3-mgd	$2,073,084
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$804,800
	TOTAL DIRECT COST				$5,030,000
	GENERAL CONDITIONS			10%	$503,000
	SUBTOTAL				$5,530,000
	CONTINGENCY			20%	$1,106,000
	SUBTOTAL				$6,640,000
	GENERAL CONTRACTOR OH&P			10%	$550,000
	SUBTOTAL				$7,190,000
	SALES TAX ON MATERIALS (7.75%)				INCLUDED IN DIRECT COSTS
	SUBTOTAL				$7,190,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - CWRF EXP.				**$7,190,000**
	PIPELINE	unit ($ per ft)	$120	8-in diam; 1,500 ft	$180,000
	PUMP STATION	unit ($ per hp)	$6,000	2-75 hp (0.75 mgd)	$900,000
	SUBTOTAL				$1,080,000
	CONTINGENCY			20%	$216,000
	SUBTOTAL				$1,300,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$1,300,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$8,490,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			27.5%	$2,334,750
	TOTAL ESTIMATED PROJECT COST				**$10,800,000**
				Capital Payment at 30 years and 6-percent interest	**($784,608)**
				annual demands added by expansion	4,098
				Cost/AF	**($191)**

Carlsbad Supply Costs

May 2011 ENR **9035**

Alternative 2 - 5.75 mgd Carlsbad Expansion (OMWD connects to CMWD System)

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	711750
10	TERTIARY FILTERS	7.5-mgd (1600 ft^2)	$1,054,555	5.8-mgd	$1,318,502
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	5.8-mgd	$1,955,548
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$759,200
				TOTAL DIRECT COST	$4,745,000
		GENERAL CONDITIONS		10%	$474,500
		SUBTOTAL			$5,220,000
		CONTINGENCY		20%	$1,044,000
		SUBTOTAL			$6,260,000
		GENERAL CONTRACTOR OH&P		10%	$520,000
		SUBTOTAL			$6,780,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$6,780,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - CWRF EXP.				**$6,780,000**
	Increased Pipeline Cost (16-inch diam instead of 12-inch diam)				$770,000
	PIPELINE	unit ($ per ft)	$120	8-in diam; 1,500 ft	$180,000
	PUMP STATION	unit ($ per hp)	$6,000	2-75 hp (0.75 mgd)	$900,000
	2 Booster Pumping Stations in OMWD's System				$3,540,000
		SUBTOTAL			$5,390,000
		CONTINGENCY		20%	$1,078,000
		SUBTOTAL			$6,470,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$6,470,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$13,250,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			28%	$3,643,750
	TOTAL ESTIMATED PROJECT COST				**$16,900,000**
				Capital Payment at 30 years and 6-percent interest	**($1,227,767)**
				annual demands added by expansion	4,098
				Cost/AF	**($300)**

Carlsbad Supply Costs

May 2011 ENR **9035**

Alternative 3 - 3 mgd Gafner WRP Expansion & 3 mgd Carlsbad WRF Expansion

NO.	Gafner WRP New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost	$470,700	15% of direct cost	$470,700
13	EFFLUENT PUMPING	5-mgd	$1,041,368	3.4-mgd	$902,465
11	CHLORINE CONTACT BASINS	2 CCBs similar	$1,590,644	1 CCB	$1,262,840
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost	$502,080	16% of direct cost	$502,080
				Gafner WRP TOTAL DIRECT COST	$3,138,000
		GENERAL CONDITIONS		10%	$313,800
		SUBTOTAL			$3,450,000
		CONTINGENCY		20%	$690,000
		SUBTOTAL			$4,140,000
		GENERAL CONTRACTOR OH&P		10%	$350,000
		SUBTOTAL			$4,490,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$4,140,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - GWRF EXP.				**$4,140,000**
	Increased Pipeline Cost (16-inch diam instead of 12-inch diam)				$700,000
	PIPELINE	unit ($ per ft)	$290	16-in diam; 1,500 ft	$435,000
		Replace Failsafe Line to Gafner WRP			$7,337,000
		SUBTOTAL			$8,470,000
		CONTINGENCY		20%	$1,694,000
		SUBTOTAL			$10,160,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$10,160,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$14,300,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			28%	$3,932,500
	ESTIMATED PROJECT COSTS - NON RO				**$18,200,000**
	Gafner MF/RO Treatment Costs				
		2.5 mgd	$31,378,148	3 mgd	$35,649,561
	TOTAL ESTIMATED PROJECT COSTS				**$53,800,000**
				Capital Payment at 30 years and 6-percent interest	**($3,908,511)**
				3-mgd in afy	3,360
				Cost/AF	**($1,163)**

Carlsbad Supply Costs

May 2011 ENR **9035**

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost	$451,350	15% of direct cost	$451,350
10	TERTIARY FILTERS	7.5-mgd (1600 ft^2)	$1,054,555	3.0-mgd	$836,177
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	3.0-mgd	$1,240,183
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost	$481,440	16% of direct cost	$481,440
				Carlsbad WRF TOTAL DIRECT COST	$3,009,000
		GENERAL CONDITIONS		10%	$300,900
		SUBTOTAL			$3,310,000
		CONTINGENCY		20%	$662,000
		SUBTOTAL			$3,970,000
		GENERAL CONTRACTOR OH&P		10%	$330,000
		SUBTOTAL			$4,300,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$4,300,000
		TOTAL ESTIMATED CONSTRUCTION COST			**$4,300,000**
		ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT		28%	$1,182,500
		TOTAL ESTIMATED PROJECT COSTS			**$19,800,000**
				Capital Payment at 30 years and 6-percent interest	**($1,438,448)**
				2-mgd in afy	3,360
				Cost/AF	**($428)**
		TOTAL ESTIMATED PROJECT COSTS - BOTH PLANTS			**$73,600,000**
				Capital Payment at 30 years and 6-percent interest	**($5,346,960)**
				annual demands added by expansion	4,098
				Cost/AF	**($1,305)**

Engineers...Working Wonders With Water®

		Flow	**2.5**
		ESTIMATE CLASS:	2
	PROJECT SUMMARY	**PIC:**	GFC
PROJECT : MF/RO Estimate CMWD		**PM:**	MSB
		DATE :	January 22, 2010
LOCATION : Carlsbad, CA		**BY :**	MSB
ELEMENT : MF-RO (2.5 mgd)		**REVIEWED:**	

NO.	DESCRIPTION		TOTAL
1	GENERAL CONDITIONS	10%	$1,301,782
2	SITEWORK AND YARD PIPING	5%	$650,891
3	MICRO FILTRATION		$4,792,800
4	REVERSE OSMOSIS		$3,223,908
5	DISINFECTION		$1,095,765
6	ELECTRICAL	10%	$1,301,782
7	INSTRUMENTATION & CONTROL	5%	$650,891
	TOTAL DIRECT COST		**$13,017,819**
	CONTINGENCY	25.0%	$3,254,455
	SUBTOTAL		**$16,272,274**
	GENERAL CONTRACTOR OVERHEAD, PROFIT & RISK	10.0%	$1,627,227
	SUBTOTAL		**$17,899,501**
	ESCALATION TO MID-POINT (3% for 6 years)	19.4%	$3,473,439
	SUBTOTAL		**$21,372,940**
	SALES TAX (Based on 8.75%)	8.8%	$1,870,132
	SUBTOTAL		**$23,243,073**
	BID MARKET ALLOWANCE	0.0%	$0
	TOTAL ESTIMATED CONSTRUCTION COST	$36,260,892	**$23,243,073**
	ENGINEERING, LEGAL & ADMIN. FEES	30.0%	$6,972,922
	OWNER'S RESERVE FOR CHANGE ORDERS	5.0%	$1,162,154
	TOTAL ESTIMATED PROJECT COST		**$31,378,148**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Carlsbad Supply Costs

May 2011 ENR **9035**

Alternative 4 - 7 mgd Carlsbad WRF Expansion and Abandon Gafner WTP

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	$816,900
10	TERTIARY FILTERS	7.5-mgd (1600 ft^2)	$1,054,555	7.0-mgd	$1,513,150
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	7.0-mgd	$2,244,242
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$871,360
				TOTAL DIRECT COST	$5,446,000
		GENERAL CONDITIONS		10%	$544,600
		SUBTOTAL			$5,990,000
		CONTINGENCY		20%	$1,198,000
		SUBTOTAL			$7,190,000
		GENERAL CONTRACTOR OH&P		10%	$600,000
		SUBTOTAL			$7,790,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$7,790,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - CWRF EXP.				**$7,790,000**
	PIPELINE	unit ($ per ft)	$120	8-in diam; 1,500 ft	$180,000
		SUBTOTAL			$180,000
		CONTINGENCY		20%	$36,000
		SUBTOTAL			$220,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$220,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$8,010,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			28%	$2,202,750
	TOTAL ESTIMATED PROJECT COST				**$10,200,000**
				Capital Payment at 30 years and 6-percent interest	**($741,019)**
				annual demands added by expansion	4,098
				Cost/AF	**($181)**

Carlsbad Supply Costs

May 2011 ENR **9035**

Alternative 5 - 5 mgd CWRF Expansion & 1 mgd plant at the Calavera Res.

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	$645,415
10	TERTIARY FILTERS	7.5-mgd (1600 ft^2)	$1,054,555	5.0-mgd	$1,195,618
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	5.0-mgd	$1,773,291
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$688,443
				TOTAL DIRECT COST	$4,302,766
		GENERAL CONDITIONS		10%	$430,276.61
		SUBTOTAL			$4,730,000
		CONTINGENCY		20%	$946,000
		SUBTOTAL			$5,680,000
		GENERAL CONTRACTOR OH&P		10%	$470,000
		SUBTOTAL			$6,150,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$6,150,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - CWRF EXP.				**$6,150,000**
	PIPELINE	unit ($ per ft)	$120	8-in diam; 1,500 ft	$180,000
	PUMP STATION	unit ($ per hp)	$6,000	2-75 hp (0.75 mgd)	$900,000
		SUBTOTAL			$1,080,000
		CONTINGENCY		20%	$216,000
		SUBTOTAL			$1,300,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$1,300,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$7,450,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			28%	$2,048,750
	TOTAL ESTIMATED PROJECT COST				**$9,500,000**
				Capital Payment at 30 years and 6-percent interest	**($690,165)**
				4-mgd in afy	4,481
				Cost/AF	**($154)**
	Calavera Res. Stormwtr Treatment Costs				
	Conventional Water Treatment	1.0 mgd	$8,500,000	1 mgd	$8,697,763
	Transmission Main			8-inch for 4000 ft	$731,520
	TOTAL ESTIMATED PROJECT COST				**$9,400,000**
				Capital Payment at 30 years and 6-percent interest	**($682,900)**
				1-mgd in afy	1,120
				Cost/AF	**($610)**
	TOTAL ESTIMATED PROJECT COST				**$18,900,000**
				Capital Payment at 30 years and 6-percent interest	**($1,373,064)**
				annual demands added by expansion	4,098
				Cost/AF	**($335)**

Carlsbad Supply Costs

May 2011 ENR **9035**

Alternative 6 - 5.75 mgd CWRF Expansion & 1 mgd from Shadowridge.

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	$711,750
10	TERTIARY FILTERS	7.5-mgd (1600 ft^2)	$1,054,555	5.8-mgd	$1,318,502
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	5.8-mgd	$1,955,548
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$759,200
				TOTAL DIRECT COST	$4,745,000
		GENERAL CONDITIONS	10%		$474,500.01
		SUBTOTAL			$5,220,000
		CONTINGENCY	20%		$1,044,000
		SUBTOTAL			$6,260,000
		GENERAL CONTRACTOR OH&P	10%		$520,000
		SUBTOTAL			$6,780,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$6,780,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - CWRF EXP.				**$6,780,000**
	PIPELINE	unit ($ per ft)	$120	8-in diam; 1,500 ft	$180,000
	PUMP STATION	unit ($ per hp)	$6,000	2-75 hp (0.75 mgd)	$900,000
		SUBTOTAL			$1,080,000
		CONTINGENCY		20%	$216,000
		SUBTOTAL			$1,300,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$1,300,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$8,080,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT		28%		$2,222,000
	TOTAL ESTIMATED PROJECT COST - CARLSBAD WRF				**$10,300,000**
				Capital Payment at 30 years and 6-percent interest	**($748,284)**
				5-mgd in afy	5,601
				Cost/AF	**($134)**
	Shadowridge Reactivation Costs				
	From Draft VID Report			1 mgd	$12,300,000
	Conveyance				$190,000
	TOTAL ESTIMATED PROJECT COST - SHADOWRIDGE WRF				**$12,490,000**
				Capital Payment at 30 years and 6-percent interest	**($907,385)**
				0.7-mgd in afy	368
				Cost/AF	**($2,469)**
	TOTAL ESTIMATED PROJECT COST				**$22,800,000**
				Capital Payment at 30 years and 6-percent interest	**($1,656,395)**
				annual demands added by expansion	4,098
				Cost/AF	**($404)**

Appendix B – Part 2

Carlsbad Supply Costs

May 2011 ENR	9035
Location Factor (Carlsbad)	1.040

Phase III 4 mgd Carlsbad WRF Expansion

No.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	$552,150
10	TERTIARY FILTERS	7.5-mgd (1,600 ft^2)	$1,054,555	4.0-mgd	$1,022,717
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	4.0-mgd	$1,516,851
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$588,960
				TOTAL DIRECT COST	$3,681,000
		GENERAL CONDITIONS		10%	$368,100
		SUBTOTAL			$4,050,000
		CONTINGENCY		20%	$810,000
		SUBTOTAL			$4,860,000
		GENERAL CONTRACTOR OH&P		10%	$410,000
		SUBTOTAL			$5,270,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$5,270,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - CWRF EXP.				**$5,270,000**
	PIPELINE	unit ($ per ft)	$120	8-in diam; 1,500 ft	$180,000
		SUBTOTAL			$180,000
		CONTINGENCY		20%	$36,000
		SUBTOTAL			$220,000
	SUBTOTAL ESTIMATED CONSTRUCTION COST - INF.				**$220,000**
	TOTAL ESTIMATED CONSTRUCTION COST				**$5,490,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			28%	$1,509,750
	TOTAL ESTIMATED PROJECT COST				**$7,000,000**

Build Out 3 mgd Carlsbad WRF Expansion

NO.	Carlsbad WRF New Facilities	Reference Criteria	Reference Cost	Proposed Criteria	May 2011 Estimate
1	YARDWORK/REMOVALS/DEMOLITION	15% of direct cost		15% of direct cost	$451,350
10	TERTIARY FILTERS	7.5-mgd (1,600 ft^2)	$1,054,555	3.0-mgd	$836,177
11	CHLORINE CONTACT BASINS	2 CCBs (5-mgd)	$1,590,644	3.0-mgd	$1,240,183
20	ELECTRICAL AND INSTRUMENTATION	16% of direct cost		16% of direct cost	$481,440
				TOTAL DIRECT COST	$3,009,000
		GENERAL CONDITIONS		10%	$300,900
		SUBTOTAL			$3,310,000
		CONTINGENCY		20%	$662,000
		SUBTOTAL			$3,970,000
		GENERAL CONTRACTOR OH&P		10%	$330,000
		SUBTOTAL			$4,300,000
		SALES TAX ON MATERIALS (7.75%)			INCLUDED IN DIRECT COSTS
		SUBTOTAL			$4,300,000
	TOTAL ESTIMATED CONSTRUCTION COST				**$4,300,000**
	ENGIN., LEGAL, ADMIN. AND CONSTR. MANAGEMENT			28%	$1,182,500
	TOTAL ESTIMATED PROJECT COST				**$5,500,000**

Appendix C

CUSTOMER DATABASE

Appendix C - Potential Users from Potable Water Customer Database

Recycled Water Master Plan Update

Carlsbad Municipal Water District

Map ID [1]	Customer Name	Type	Estimated Average Annual Demand[2]			SPF	Address		Purveyor	Expansion Alignment	Zone	Included in Ultimate System	Comment
			gpm	afy	mgd	SPF	No.	Address					
C001	OMWD Customers (Gafner WRP or from Carlsbad WRF via El Camino)	Landscape Irrigation	310.0	500.0	0.45	1.4			OMWD	8	384	Y	Lower Zones
C002	NRC West Coast LLC / Cabrillo Power	Industrial	440.8	711.0	0.63	1.3	4900	BLK CARLSBAD BL	CMWD	2	384	Y	NRC West Coast LLC / Cabrillo Power
C003	Shadowridge Golf Course	Golf Courses	277.8	448.1	0.40	1.7	1980	GATEWAY DR	VID	4A	550	Y	
C004	KSL Resorts: La Costa Resort (Group)	Resort Property Irriga	12.4	20.0	0.02	1.7	2100	COSTA DEL MAR RD	CMWD	8	384	Y	La Costa Golf Course / Resort
C005	Robertson's Ranch - West Village (Phase 2)	HOA	73.3	118.3	0.11	1.7			Dev	5	384	Y	Robertson's Ranch - West Village (Phase 2)
C008	Rancho Carlsbad MHP	HOA	21.7	35.0	0.03	1.7			CMWD	3	384	Y	aka Rancho Carlsbad HOA; Drawings provided by District.
C009	Robertson's Ranch - East Village (Phase 1)	HOA	40.8	65.8	0.06	1.7			Dev	Near Existing	550	Y	Robertson's Ranch - East Village (Phase 1)
C010	Tamarack Point HOA	HOA	26.0	42.0	0.04	1.7		TAMARACK AVE & PONTIA	CMWD	5	384	Y	Existing HOA; demand reduced to 42 afy per EK
C012	Rancho Carlsbad Golf Course (Executive Course)	Golf Courses	31.2	50.3	0.04	1.7	5200	EL CAMINO REAL	CMWD	14	384	Y	Rancho Carlsbad Golf Course (Executive Sized Golf Course)
C013	Invitrogen (Life Technologies)	Commercial Cooling	11.2	18.0	0.02	1.7	5781	VAN ALLEN WY	CMWD	Near Existing	550	Y	Life Technologies
C014	San Pacifico HOA	HOA	25.7	41.5	0.04	1.7			CMWD	9	318	Y	Already plumbed for irrigation demand
C017	Alta Mira HOA	HOA	8.1	13.0	0.01	1.7			CMWD	Near Existing	550	Y	Alta Mira HOA; Would Require 5 Miles of Curbing
C018	Valley Middle School (Carlsbad Unified School)	Schools	10.5	17.0	0.02	1.7			CMWD	12	384	Y	Valley Middle School
C020	Carlsbad Property Inc (Group)	Commercial Property	12.2	19.7	0.02	1.7	800	PALOMAR AIRPORT RD	CMWD	13	384	Y	Carlsbad Property Inc
C021	Pan Pacific Retail Prop Inc	Commercial Property	12.1	19.5	0.02	1.7	1850	MARRON RD	CMWD	5	384	Y	Pan Pacific Retail Prop Inc
C023	William L Canepa	Resort Property Irriga	5.0	8.0	0.01	1.7	6450	CARLSBAD BL	CMWD	2	384	Y	Future Hotel
C025	Army and Navy Academy (includes Maxton Brown Park)	Schools	11.0	17.8	0.02	1.7	2605	CARLSBAD BL	CMWD	11	384	Y	Army and Navy Academy
C026	Camino Hills HOA	HOA	11.0	17.8	0.02	1.7	5427	BROWNING RD	CMWD	3	384	Y	Camino Hills HOA
C027	Full Range Prty LLC (Carlsbad Golf Center)	Commercial Property	10.8	17.5	0.02	1.7	2711	HAYMAR DR	CMWD	5	384	Y	Full Range Prty LLC (Carlsbad Golf Center)
C028	The Village Apartments	Commercial Property	5.4	8.7	0.01	1.7	3601	ROOSEVELT ST	CMWD	11	384	Y	The Village Apts #20975
C029	Plaza Camino Real	Commercial Property	15.9	25.6	0.02	1.7	2525	EL CAMINO REAL	CMWD	5	384	Y	Plaza Camino Real
C032	OVLC Management Co. DBA / KSL (was Olympic Hotel / PAC)	Commercial Property	9.3	15.0	0.01	1.7			CMWD	Near Existing	550	Y	Construction taking place, per planning KSL Resorts; no timeline.
C033	Motel 6 - Site 000471	Commercial Property	9.2	14.9	0.01	1.7	750	RAINTREE DR	CMWD	Near Existing	550	Y	Motel 6 - Site 000471
C034	City Of Carlsbad Parks	Parks	9.2	14.9	0.01	1.7			CMWD	5	384	Y	Park
C035	Senior Center Field (City of Carlsbad Parks)	Commercial Property	2.1	3.4	< 0.01	1.7	801	PINE AV	CMWD	11	384	Y	2 Existing Meters
C037	Hope Elementary School (Group)	Schools	8.2	13.3	0.01	1.7			CMWD	5	384	Y	Hope Elementary School
C038	Ponto Hotel	Resort Property Irriga	8.0	13.0	0.01	1.7			Dev	9	318	Y	Based on 8 acres (based on aerial)
C039	Palomar Triad #520	Commercial Property	7.9	12.8	0.01	1.7	2011	PALOMAR AIRPORT RD	CMWD	1	550	Y	
C040	Kelly Elementary School (Group)	Schools	6.5	10.5	0.01	1.7			CMWD	5	384	Y	Kelly Elementary School
C041	Carlsbad High School (Group)	Schools	6.3	10.1	0.01	1.7			CMWD	12	384	Y	10 Potable Mt; Assd only 2007 Irrig; 180' to 208'
C042	La Costa Meadows Elementary School	Schools	6.0	9.7	0.01	1.7	6889	EL FUERTE ST	VWD	6	742	Y	School
C043	Brierly Field (City Of Carlsbad Parks)	Parks	6.0	9.6	0.01	1.7			CMWD	11	384	Y	Park
C044	Existing Landscape Meters near Impala Dr and Palmer Wy	Commercial Property	19.2	31.0	0.03	1.7			CMWD	18	550	Y	17 Existing Meters
C045	Holiday Park (City Of Carlsbad Parks)	Parks	5.8	9.3	0.01	1.7			CMWD	11	384	Y	Park
C046	Holiday Park (City Of Carlsbad Parks)	Parks	5.3	8.5	0.01	1.7			CMWD	11	384	Y	Park
C047	Chase Field (City Of Carlsbad Parks)	Parks	5.1	8.3	0.01	1.7			CMWD	11	384	Y	Park
C049	Equity Growth Invest	Commercial Property	4.9	7.9	0.01	1.7	2225	CAMINO VIDA ROBLE	CMWD	1	550	Y	
C050	Carlsbad Commercial Center	Commercial Property	4.8	7.8	0.01	1.7	5122	AVENIDA ENCINAS	CMWD	2	384	Y	
C051	City Of Carlsbad Parks	Schools	4.5	7.3	0.01	1.7	1301	LAS FLORES	CMWD	11	384	Y	Ball Field for Buena Vista Elementary School
C052	Carlsbad Point Corporation	Commercial Property	4.3	7.0	0.01	1.7	5825	AVENIDA ENCINAS	CMWD	2	384	Y	
C053	Gildred Development	Commercial Property	4.2	6.8	0.01	1.7	5411	AVENIDA ENCINAS	CMWD	2	384	Y	
C054	2052 CDN LLC	Commercial Property	4.2	6.8	0.01	1.7	2052	CORTE DEL NOGAL	CMWD	1	550	Y	
C055	North Pointe HOA	HOA	0.9	1.5	< 0.01	1.7	6155	EL CAMINO REAL	CMWD	Near Existing	550	Y	
C056	Greenview HOA	HOA	4.0	6.4	0.01	1.7		ALMADEN LN	CMWD	17	384	Y	Greenview HOA
C057	Cognac Pacific Corporate LLC	Commercial Property	4.0	6.4	0.01	1.7	5999	AVENIDA ENCINAS	CMWD	2	384	Y	
C058	H G Fenton	Commercial Property	3.8	6.1	0.01	1.7	6351	CORTE DEL ABETO	CMWD	1	550	Y	
C059	Cognac Carlsbad Pac Centr LLC	Commercial Property	3.8	6.1	0.01	1.7	701	PALOMAR AIRPORT RD	CMWD	2	384	Y	
C060	Buena Vista Elementary School (Group)	Schools	1.2	2.0	< 0.01	1.7			CMWD	11	384	Y	Buena Vista Elementary School
C061	North Pointe HOA	HOA	3.7	6.0	0.01	1.7	6213	EL CAMINO REAL	CMWD	1	550	Y	

	Map ID [1]	Customer Name	Type	Estimated Average Annual Demand[2]			SPF	Address		Purveyor	Expansion Alignment	Zone	Included in Ultimate System	Comment
				gpm	afy	mgd	SPF	No.	Address					
	C062	Viaggio HOA and Aviara Masters HOA	HOA	5.7	9.2	0.01	1.7	7073	BLACK RAIL CT	CMWD	15	384	Y	4 Existing Meters
	C063	City Of Carlsbad Parks	Parks	3.5	5.7	0.01	1.7			CMWD	Not Included	-	N	Park
	C064	Future Parcel - Carlsbad Airport Center	Commercial Property	1.1	1.8	< 0.01	1.7			Dev	Near Existing	550	Y	Adjacent to Existing System
	C065	Windstar Carlsbad Office LLC / Floral Trade Center	Commercial Property	3.4	5.5	< 0.01	1.7	5600	AVENIDA ENCINAS	CMWD	2	384	Y	
	C066	Public Storage Inc	Commercial Property	3.3	5.3	< 0.01	1.7	6211	CORTE DEL ABETO	CMWD	1	550	Y	
	C067	Magnolia Elementary School (Carlsbad Unified School)	Schools	1.9	3.1	< 0.01	1.7			CMWD	12	384	Y	1 Existing Irrigation Meter
	C068	Dolphin Beach Apartments	HOA	0.6	1.0	< 0.01	1.7			CMWD	11	384	Y	1 Existing Meter
	C069	Kilwa Manufacturing Inc	Commercial Property	3.2	5.2	< 0.01	1.7	2045	CORTE DEL NOGAL	CMWD	1	550	Y	
	C070	Jefferson Elemenatary School Irrigation (City Of Carlsbad Parks)	Schools	3.2	5.1	< 0.01	1.7			CMWD	11	384	Y	Jefferson Elementary School
	C071	Realty Associates Fund VII LP	Commercial Property	3.2	5.1	< 0.01	1.7	2121	PALOMAR AIRPORT RD	CMWD	Not Included	-	N	
	C072	Lakeshore Gardens MHP (Group)	Pond Evaporation	3.1	5.0	< 0.01	1.7	7201	AVENIDA ENCINAS	CMWD	9	318	Y	Lakeshore Gardens Mhp#7520580
	C073	Naturemaker Inc	Commercial Property	3.1	5.0	< 0.01	1.7	6225	EL CAMINO REAL	CMWD	Near Existing	550	Y	
	C074	Inns Of America Suites	Commercial Property	3.1	5.0	< 0.01	1.7	5010	AVENIDA ENCINAS	CMWD	2	384	Y	
	C075	Cognac Carlsbad Pacifica LLC	Commercial Property	3.1	5.0	< 0.01	1.7	5050	AVENIDA ENCINAS	CMWD	2	384	Y	
	C076	Future Parcel - Carlsbad Airport Center	Commercial Property	1.6	2.6	< 0.01	1.7		0	Dev	Near Existing	550	Y	Adjacent to Existing System
	C078	City Of Carlsbad Parks	Parks	2.9	4.6	< 0.01	1.7			CMWD	5	384	Y	Park
	C079	Palomar And Company	Commercial Property	2.8	4.4	< 0.01	1.7	5952	AVENIDA ENCINAS	CMWD	2	384	Y	
	C080	Inns Of America Suites	Commercial Property	2.7	4.4	< 0.01	1.7	5010	AVENIDA ENCINAS	CMWD	2	384	Y	
	C081	Bond Ranch	Commercial Property	2.6	4.3	< 0.01	1.7	2042	CORTE DEL NOGAL	CMWD	1	550	Y	
	C082	Boi Carlsbad Inc	Commercial Property	2.6	4.2	< 0.01	1.7	2035	CORTE DEL NOGAL	CMWD	1	550	Y	
	C083	CBRE Carlsbad Commercial Ctr	Commercial Property	2.6	4.2	< 0.01	1.7	5379	AVENIDA ENCINAS	CMWD	2	384	Y	
	C084	North Pointe Owners' Assoc	HOA	1.2	2.0	< 0.01	1.7	6155	EL CAMINO REAL	CMWD	Near Existing	550	Y	
	C085	Palomar Lot 10 BCA	Commercial Property	2.5	4.0	< 0.01	1.7	6050	CORTE DEL CEDRO	CMWD	1	550	Y	
	C086	Realty Associates Fund VII LP	Commercial Property	2.5	4.0	< 0.01	1.7	2141	PALOMAR AIRPORT RD	CMWD	1	550	Y	
	C087	Tramanto HOA	HOA	2.4	3.8	< 0.01	1.7	1950	HUMMINGBIRD RD	CMWD	15	384	Y	Existing Landscape Meter
	C088	St. Elizabeth Seton Church	Schools	1.1	1.8	< 0.01	1.7	6628	SANTA ISABEL ST	VWD	6	742	Y	St. Elizabeth Seton Church
	C089	Carlsbad Corporate Center	Commercial Property	2.2	3.5	< 0.01	1.7	2032	CORTE DEL NOGAL	CMWD	1	550	Y	
	C090	Bressi Ranch Corp Ctr	HOA	2.1	3.4	< 0.01	1.7			CMWD	Near Existing	550	Y	Bressi Ranch Corp Ctr
	C091	Spy Optic Inc	Commercial Property	2.1	3.4	< 0.01	1.7	2070	LAS PALMAS DR	CMWD	1	550	Y	
	C092	Del Abeto Cntr #260	Commercial Property	1.9	3.1	< 0.01	1.7	6352	CORTE DEL ABETO	CMWD	1	550	Y	
	C093	Palomar 910 Assoc Ltd	Commercial Property	1.6	2.6	< 0.01	1.7	6351	YARROW DR	CMWD	1	550	Y	
	C094	Guy Freeborn	Commercial Property	1.6	2.5	< 0.01	1.7	2385	CAMINO VIDA ROBLE	CMWD	Near Existing	550	Y	
	C096	Micro-Probe Prop LLC	Commercial Property	1.5	2.4	< 0.01	1.7	2281	LAS PALMAS DR	CMWD	Near Existing	550	Y	
	C099	CBRE - Josepho Family Trust	Commercial Property	0.7	1.1	< 0.01	1.7	2101	CAMINO VIDA ROBLE	CMWD	1	550	Y	
	C100	Sierra Land Group Inc	Commercial Property	0.6	0.9	< 0.01	1.7	2091	LAS PALMAS DR	CMWD	1	550	Y	
	C101	Business Park (Vista Irrigation District)	Commercial Property	361.0	582.3	0.52	1.7			VID	4C	660	Y	
	C102	Lake San Marcos Resort Country Club	Golf Courses	208.3	336.0	0.30	1.7			VWD	Not Included	-	N	
	C103	Ocean Hills Country Club	Golf Courses	91.8	148.0	0.13	1.7			COO	4B	550	Y	
	C104	Hosp Grove Park	Parks	1.2	2.0	< 0.01	1.7			CMWD	5	384	Y	
	C105	Lake San Marcos Executive Golf Course	Golf Courses	61.9	99.9	0.09	1.7			VWD	Not Included	-	N	
	C107	Alga Norte Park (Future)	Parks	44.6	71.9	0.06	1.7			Dev	Near Existing	550	Y	
	C108	La Costa Canyon High	Schools	39.6	63.9	0.06	1.7			OMWD	Not Included	-	N	
	C109	Future High School Site	Schools	18.6	30.0	0.03	1.7			Dev	Near Existing	550	Y	
	C110	Business Park Cooling Towers in Carlsbad Airport Center	Commercial Cooling	6.1	9.9	0.01	1.7			CMWD	Near Existing	550	Y	
	C111	Buena Vista Park	Parks	33.2	53.5	0.05	1.7			VID	4B	550	Y	
	C112	Business Park (Vallecitos Water District)	Commercial Property	26.5	42.7	0.04	1.7			VWD	10	550	Y	
	C113	Park	Parks	24.6	39.7	0.04	1.7			VWD	10	550	Y	
	C114	Rancho Buena Vista High	Schools	24.3	39.2	0.03	1.7			VID	4B	550	Y	
	C115	Oak Riparian Park	Parks	22.6	36.5	0.03	1.7			COO	Not Included	-	N	
	C116	Business Park Cooling Towers in Carlsbad Research Center	Commercial Cooling	18.6	30.0	0.03	1.7			CMWD	Near Existing	550	Y	
	C117	Madison Middle/lake Elementary	Schools	20.8	33.6	0.03	1.7			COO	4B	550	Y	
	C118	Future School	Schools	19.5	31.4	0.03	1.7			OMWD	Not Included	-	N	
	C119	Business Park Cooling Towers in Carlsbad Oaks	Commercial Cooling	2.7	4.4	< 0.01	1.7			CMWD	Near Existing	550	Y	

Map ID [1]	Customer Name	Type	Estimated Average Annual Demand[2]			SPF	Address		Purveyor	Expansion Alignment	Zone	Included in Ultimate System	Comment
			gpm	afy	mgd	SPF	No.	Address					
C120	La Costa Canyon Park	Parks	17.1	27.5	0.02	1.7			OMWD	Not Included	-	N	
C121	Lake Park	Parks	13.9	22.4	0.02	1.7			COO	4B	550	Y	
C122	La Costa Hights Elementary/Levante Park	Parks	12.9	20.8	0.02	1.7			OMWD	Not Included	-	N	
C123	San Marcos High School	Schools	11.9	19.2	0.02	1.7			VWD	Not Included	-	N	Acres of Irrigated Turf (17.15)
C124	New Venture Christian Schools	Schools	8.3	13.4	0.01	1.7			COO	4B	550	Y	
C125	Center for Science/Math/Technology	Schools	7.6	12.3	0.01	1.7			VID	Not Included	-	N	
C126	High-Density Residential Development at Quarry Creek	HOA	40.0	64.5	0.06	1.7			Dev	7	580	Y	
C127	El Camino Creek Elementary	Schools	7.0	11.4	0.01	1.7			OMWD	Not Included	-	N	
C128	Olivenhain Pioneer Elementary	Schools	7.0	11.4	0.01	1.7			OMWD	Not Included	-	N	
C129	Breeze Hill Park	Parks	6.7	10.9	0.01	1.7			VID	4B	550	Y	
C130	Mission Estancia Elementary	Schools	6.3	10.1	0.01	1.7			OMWD	Not Included	-	N	
C131	Cadencia Park	Parks	6.0	9.7	0.01	1.7			OMWD	Not Included	-	N	
C132	Rotary Park	Parks	1.4	2.2	< 0.01	1.7			CMWD	11	384	Y	Demand from Existing Meter
C133	Fuerte Park	Parks	5.1	8.2	0.01	1.7			VWD	6	742	Y	
C134	Breeze Hill Elementary	Schools	4.9	7.9	0.01	1.7			VID	4B	550	Y	
C135	Magee Park	Parks	2.9	4.6	< 0.01	1.7			CMWD	11	384	Y	
C136	Tri City Christian Schools	Schools	2.3	3.7	< 0.01	1.7			VID	Not Included	-	N	
C137	Discovery Isle Child Development	Schools	2.2	3.6	< 0.01	1.7			CMWD	Near Existing	550	Y	
C139	Montessori of Oceanside	Schools	0.6	0.9	< 0.01	1.7			COO	4B	550	Y	
C140	Irrigation Meters in Palisades and Telescope HOA	HOA	7.3	11.7	0.01	1.7			CMWD	5	384	Y	5 Existing Meters
C141	Beythlechim	Schools	0.4	0.6	< 0.01	1.7			CMWD	Not Included	-	N	
C142	La Costa Valley Preschool and Kindergarten	Schools	0.3	0.5	< 0.01	1.7			OMWD	Not Included	-	N	
C143	Legoland Inner Park Expansion	Resort Property Irriga	20.8	33.6	0.03	1.7			Dev	Near Existing	550	Y	Anticipated between 2021 and 2024
C144	Gemological Institute of America Expansion	Commercial Property	3.2	5.2	< 0.01	1.7			Dev	Near Existing	550	Y	Anticipated between 2018 and 2025
C145	Carlsbad Ranch Resort	Commercial Property	23.5	37.9	0.03	1.7			Dev	Near Existing	550	Y	Anticipated between 2015 and 2018
C146	Dos Colinas (Senior Independent and Assisted Care Living)	HOA	37.0	59.7	0.05	1.7			Dev	3	384	Y	Anticipated by 2013
C147	Walmart / Sunny Creek Plaza	Commercial Property	7.4	12.0	0.01	1.7			Dev	3	384	Y	Anticipated between 2015 and 2020
C148	Cantarini	HOA	71.3	115.0	0.10	1.7			Dev	3	384	Y	Anticipated between 2012 and 2014
C149	Holly Springs	HOA	57.7	93.1	0.08	1.7			Dev	3	384	Y	Anticipated by 2013
C150	Carlsbad Oaks North - Phase I	Commercial Property	26.1	42.1	0.04	1.7			Dev	Near Existing	550	Y	Anticipated between 2012 and 2020
C151	Carlsbad Oaks North - Phase II	Commercial Property	21.1	34.0	0.03	1.7			Dev	Near Existing	550	Y	Anticipated between 2020 and 2023
C152	Carlsbad Oaks North - Phase III	Commercial Property	22.5	36.3	0.03	1.7			Dev	Near Existing	550	Y	Anticipated between 2023 and 2026
C153	Bressi Ranch - Planning Areas 1 through 4	Commercial Property	27.0	43.5	0.04	1.7			Dev	Near Existing	550	Y	Partial Development in 2011
C154	Bressi Ranch - Planning Area 5	Commercial Property	6.1	9.9	0.01	1.7			Dev	Near Existing	550	Y	
C155	Bressi Ranch - Planning Area 15	Commercial Property	6.4	10.4	0.01	1.7			Dev	Near Existing	550	Y	
C156	Rancho Carrillo Village H - Palomar Korean Church	Commercial Property	1.5	2.4	< 0.01	1.7			Dev	Near Existing	550	Y	Anticipated in 2011
C157	Carlsbad Raceway and Palomar Forum - Remaining Vacant Parcels	Commercial Property	27.6	44.6	0.04	1.7			Dev	Near Existing	550	Y	Anticipated between 2011 and 2026
C158	HOA	HOA	6.9	11.1	0.01	1.7			Dev	5	384	Y	
C159	Existing Landscape Meters along Palomar Oaks Way	Commercial Property	9.7	15.7	0.01	1.7		PALOMAR OAKS WAY	CMWD	1	550	Y	7 Existing Meters
C160	Future Business Park Irrigation along Palomar Oaks	Commercial Property	5.0	8.0	0.01	1.7		PALOMAR OAKS WAY	Dev	1	550	Y	Planned Future Development
C161	Existing Landscape Meters along Car Country Drive	Commercial Property	7.4	12.0	0.01	1.7		CAR COUNTRY DRIVE	CMWD	13	384	Y	6 Existing Meters
C162	Existing Landscape Meters along Frost Avenue	HOA	5.0	8.0	0.01	1.7		FROST AVENUE	CMWD	14	384	Y	4 Existing Meters
C163	Existing Colony at Calavera Irrigation Meters	HOA	4.5	7.2	0.01	1.7		TAMARACK AVENUE	CMWD	5	384	Y	4 Existing Meters
C164	Existing Landscape Meters along El Camino Real	HOA	1.2	2.0	< 0.01	1.7		EL CAMINO REAL	CMWD	5	384	Y	4 Existing Meters
C165	Existing Landscape Meters at Marbella (Apartment Complex)	HOA	1.2	2.0	< 0.01	1.7		MARRON ROAD	CMWD	5	384	Y	2 Existing Meters
C166	Existing Landscape Meters at Marea	HOA	5.3	8.6	0.01	1.7		SURFBIRD	CMWD	15	384	Y	4 Existing Meters
C167	Existing Landscape Meters along Blue Orchid Lane	HOA	6.0	9.7	0.01	1.7		BLUE ORCHID LANE	CMWD	16	384	Y	3 Existing Meters
C168	Existing Landscape Meters at Alga Hills HOA	HOA	10.7	17.2	0.02	1.7			CMWD	17	384	Y	6 Existing Meters
C169	Existing Landscape Meters at Jockey Club HOA	HOA	9.8	15.8	0.01	1.7		ALMADEN LANE	CMWD	17	384	Y	2 Existing Meters
C170	Existing Landscape Meters along Altisma Way	HOA	2.5	4.0	< 0.01	1.7		ALTISMA WAY	CMWD	17	384	Y	4 Existing Meters
C171	Existing Landscape Meters at Alicante Hills HOA	HOA	8.9	14.4	0.01	1.7			CMWD	17	384	Y	5 Existing Meters
C172	Existing Landscape Meters along Navigator Circle	HOA	2.1	3.4	< 0.01	1.7		NAVIGATOR CIRCLE	CMWD	9	318	Y	2 Existing Meters
C173	Library and Civic Center (City of Carlsbad Library and Parks)	Parks	3.1	5.0	< 0.01	1.7		LAGUNA DRIVE	CMWD	11	384	Y	2 Existing Meters

	Map ID [1]	Customer Name	Type	Estimated Average Annual Demand[2]			SPF	Address		Purveyor	Expansion Alignment	Zone	Included in Ultimate System	Comment
				gpm	afy	mgd	SPF	No.	Address					
	C174	Existing Landscape Meters at HOAs on Chinquapin Ave	HOA	14.9	24.0	0.02	1.7			CMWD	11	384	Y	8 Existing Meters (Windsong HOA)
	C175	Existing Landscape Meters along Oak Avenue	Commercial Property	2.2	3.5	< 0.01	1.7		OAK AVENUE	CMWD	11	384	Y	3 Existing Meters
	C176	Carlsbad Village Academy	Schools	6.8	11.0	0.01	1.7			CMWD	12	384	Y	Existing Institutional Meter; Assd Serves Only Irrig
	C177	Existing Landscape Meter at Avenida Encinas	Commercial Property	9.2	14.9	0.01	1.7	7190	AVENIDA ENCINAS	CMWD	9	318	Y	Existing Meter
	C178	Existing Landscape Meters at The Villa HOA	HOA	12.4	20.0	0.02	1.7		CHATHAM ROAD	CMWD	5	384	Y	4 Existing Meters
	C179	Existing Landscape Meters at Fairways HOA	HOA	16.6	26.8	0.02	1.7			CMWD	17	384	Y	8 Existing Meters
		Customer Database Total		3,328	5,368	4.79								

Notes:

(1) Map ID corresponds to the ID in the GIS database. The customers are displayed by Map ID on Figure 3.8.

(2) Estimated demand is based on the potable water billing records. If potable records were not available, demand is based on the demand factors developed in Chapter 3.

(3) During the demand identification process, customer questionaires were sent to large users to better understand their needs and demands.

(4) Likelihood of service was based on the customer questionaire and discussions with the City. If unknown, the likelihood was assumed to be 75%, a typical value for Recycled Water Master Plans.

(5) Purveyor refers to the existing purveyor of potable water to the customer. "Dev" signifies that the customer is a new development without existing potable water use which would be offset by use of recycled water (development information was provided by the City's planning department).

Appendix D

INTERAGENCY AGREEMENTS

This appendix includes:

- Mahr Reservoir Use Agreement
- Leucadia County Water District Recycled Water Sales Agreement
- Vallecitos Water District Recycled Water Sales Agreement
- Vallecitos Water District Construction and Reconstruction of Water Lines
- Metropolitan Water District of Southern California Local Resource Program Agreement

AGREEMENT FOR SALE OF RECYCLED WATER AND USE OF MAHR RESERVOIR BETWEEN THE VALLECITOS WATER DISTRICT AND THE CARLSBAD MUNICIPAL WATER DISTRICT

This Agreement is made and entered into by and between the VALLECITOS WATER DISTRICT ("VALLECITOS"), organized and existing pursuant to Water Code section 30000 et seq., and the CARLSBAD MUNICIPAL WATER DISTRICT ("CARLSBAD"), a Public Agency organized under the Municipal Water Act of 1911, and a subsidiary district of the City of Carlsbad organized and existing pursuant to Water Code section 71000 et seq. (collectively, the "Parties").

RECITALS

A. On June 13, 1991, the Parties entered into an agreement (the "1991 Agreement") for the sale of recycled water from the VALLECITOS' Meadowlark Reclamation Facility ("MRF"). Since July 1991, VALLECITOS has provided recycled water to CARLSBAD in accordance with the terms and conditions of the 1991 Agreement.

B. VALLECITOS is currently in the process of evaluating an expansion of the MRF and the increase in production from two (2) million gallons per day ("MGD") of recycled water to a potential of five (5) MGD.

C. VALLECITOS also owns, operates, and maintains the Mahr Reservoir, which has the capacity to store fifty-four (54) million gallons ("MG") of recycled water and is located within the boundaries of both VALLECITOS and the City of Carlsbad.

D. CARLSBAD is in the process of developing an expansion of its recycled water system referred to as the Encina Basin Water Reclamation Program, Phase II Project ("Phase

II Project"). CARLSBAD desires to use the Mahr Reservoir for seasonal, operational (diurnal), and emergency storage as part of the Phase II Project. The scheduled dates for implementation of the Phase II Project is July 2005.

E. VALLECITOS agrees to allow CARLSBAD to use a portion of the storage capacity of Mahr Reservoir, provided CARLSBAD constructs certain improvements to the Mahr Reservoir. The storage capacity available to CARLSBAD in the Mahr Reservoir shall be up to 32 MG, provided CARLSBAD purchases from VALLECITOS an additional one (1) MGD of recycled water (for a total of 3 MGD) as part of the Phase II Project.

F. CARLSBAD acknowledges that delivery of the recycled water volume outlined in this Agreement is contingent upon the expansion of the MRF by VALLECITOS and sufficient development within VALLECITOS and build out of the Meadowlark area and drainage basin to provide enough effluent to produce the recycled water.

NOW, THEREFORE, the Parties agree to the following terms and conditions:

1. Construction of Mahr Reservoir Improvements. CARLSBAD shall be responsible for constructing and installing certain improvements (the "Improvements") that include, but may not be limited to, the draining and cleaning of the interior storage area of the Mahr Reservoir, installing a chlorination system and aeration system, modifying the inlet/outlet works, and installing an asphalt concrete liner and floating polypropylene cover as further described in the Encina Basin Recycled Water Distribution Study prepared by CGvL Engineers in association with John Powell & Associates, Inc., dated May 2000 (the "Study"). A copy of the Study is attached to this Agreement as Exhibit "A" and incorporated herein by reference. VALLECITOS has reviewed the Study and consents to the recommended Improvements and other pertinent improvements. CARLSBAD shall provide VALLECITOS with sixty (60) days written notice prior to beginning construction of the

improvements. Construction of the Improvements shall be subject to coordination with VALLECITOS staff. The schedule to construct the Improvements is based on CARLSBAD receiving a commitment for funding from the State of California in 2003, whereby construction would begin in 2003 and extend through 2004.

2. Funding and Design of Improvements. CARLSBAD shall construct the Improvements with funding obtained from state and federal loans and grants. CARLSBAD shall be responsible for the design and preparation of the plans and specifications for the Improvements and will obtain any necessary permits on behalf of VALLECITOS and with the written consent of VALLECITOS, which consent shall not be unreasonably withheld. All plans and specifications for the Improvements shall be submitted to VALLECITOS for review and approval, which approval shall not be unreasonably withheld. CARLSBAD shall construct the Improvements in accordance with the approved plans and specifications and permit conditions including compliance with CEQA and all other regulatory bodies. The Improvements shall become the property of VALLECITOS and shall be dedicated to VALLECITOS for operation and maintenance. If funding for the Improvements is not approved by the State of California, then CARLSBAD is not obligated to design or construct the Improvements. In the event the Improvements are not constructed, for whatever reason, all rights of CARLSBAD to purchase recycled water beyond 2 MGD and to utilize storage in the Mahr Reservoir shall terminate in the discretion of VALLECITOS.

3. Mahr Reservoir Storage Capacity. CARLSBAD shall have the right to utilize up to 32 MG of storage capacity available in the Mahr Reservoir for its Phase II Project. In the event CARLSBAD discontinues the purchase of recycled water from VALLECITOS, the use of storage capacity of the Mahr Reservoir shall automatically revert to VALLECITOS. CARLSBAD shall be allowed to utilize Mahr Reservoir for peak demands in accordance with the approved Operations and Maintenance manual referenced in Section 5. In no event shall CARLSBAD have any priority in Hydraulic Grade Line (HGL) or

available capacity of the reservoir and shall be entitled to up to a maximum of 60% of the storage available at any given time.

4. Master Flow Meters. Master recycled water flow meters ("Master Flow Meter(s)") shall be installed by CARLSBAD at or near the MRF, in locations mutually agreeable to the Parties, to measure the quantity of recycled water supplied to CARLSBAD from the MRF. VALLECITOS shall be responsible for operating, maintaining, calibrating, and reading the Master Flow Meter(s) on a routine basis. VALLECITOS shall read and report to CARLSBAD the meter results no less than once per month and shall provide copies to CARLSBAD of calibration results on an annual basis. VALLECITOS shall deliver recycled water to CARLSBAD to the mutually agreed upon locations of the Master Flow Meter(s) and shall have no responsibility or obligation to deliver recycled water beyond the Master Flow Meter location(s).

5. Ownership, Operation, and Maintenance of Mahr Reservoir Improvements. VALLECITOS shall own, operate, and maintain the Mahr Reservoir and all Improvements constructed for the Mahr Reservoir. A draft operation and maintenance manual shall be prepared by CARLSBAD for review, and approval by VALLECITOS, for operation and maintenance of the Improvements, which will be incorporated in an operations and maintenance manual for the operation of MRF, Mahr and the Failsafe pipeline. VALLECITOS shall operate the Improvements in conformance with the approved operations and maintenance manual. Notwithstanding the foregoing, in no case shall VALLECITOS be required to operate the Improvements in a fashion that will be harmful or detrimental to the operation of the MRF, Mahr Reservoir, or the Fail Safe pipeline.

6. Operation and Maintenance of Other Related Facilities. VALLECITOS shall own, operate, and maintain, per the approved operations and maintenance manual, the

recycled water transmission pipeline identified on the attached Exhibit "B," which is incorporated herein by reference.

Each party shall grant to the other necessary easements and rights-of-way to construct, operate and maintain the recycled water facilities described in this Agreement that they respectively control and assist each other to obtain easements or rights-of-way on lands controlled by other entities not subject to this Agreement.

7. Failsafe Pipeline Capacity and Operation. CARLSBAD acknowledges and agrees that under certain operational scenarios, the full production of MRF may exceed the failsafe pipeline capacity of 3 MGD and to accommodate operational goals, the Mahr Reservoir may be at capacity with no additional, available storage. To accommodate such an event, CARLSBAD agrees, per the approved operations and maintenance manual, to provide adequate facilities and operational flexibility to VALLECITOS to dispose of the additional flow into the CARLSBAD recycled water distribution system for either use or disposal. Disposal of recycled water through the CARLSBAD system is subject to and predicated upon the availability of adequate capacity at the Encina Wastewater Authority (EWA) flow equalization facility and coordination with EWA. All excess recycled water, beyond purchases required in Section 8 and peak demands, shall meet the quality requirements contained in Section 10. The method of disposing shall be identified in the operational parameters agreed upon between the Parties.

CARLSBAD agrees to completely remove the existing Phase I Pump Station, located at El Camino Real, prior to or concurrent with the initial delivery of 3 mgd of recycled water in accordance with Section 8. CARLSBAD agrees to replace the existing 12-inch Failsafe pipeline with like pipeline material in accordance with VALLECITOS standards.

8. Quantities of Recycled Water to be Purchased. During the term of this Agreement, CARLSBAD agrees to purchase, and VALLECITOS agrees to deliver to the CARLSBAD recycled water distribution system (provided flows are sufficient), the following minimum amounts of recycled water from the MRF:

a. Prior to completion of the Phase II Project, CARLSBAD shall continue to purchase a minimum of 2 MGD of recycled water which is approximately 2,240 acre-feet per year.

b. Upon completion of the Phase II Project, and provided VALLECITOS has completed the expansion of the MRF and adequate effluent is available, CARLSBAD agrees to purchase a minimum of 2 MGD of recycled water during the months of December, January, February, and March and 3 MGD of recycled water for the remaining months which is approximately 2,989 acre-feet per year.

9. Interruption of Delivery of Recycled Water. Notwithstanding the provisions of section 8 above, the Parties understand and agree that there shall be no liability to VALLECITOS to supply recycled water, or obligation of Carlsbad to purchase recycled water for day-to-day interruptions in delivery of recycled water due to plant emergencies requiring plant shut down and repairs associated with acts of God, permit compliance, orders by regulatory bodies or judicial courts, and/or equipment breakdowns, or substantial maintenance activities. VALLECITOS shall make good faith efforts to resume delivery of recycled water in a timely manner after completing the necessary efforts to restore the operation of MRF. If recycled water delivery is discontinued for more than seven (7) consecutive days, then VALLECITOS shall provide CARLSBAD a time schedule indicating when delivery is expected to resume.

10. Treatment Standards. VALLECITOS shall treat the recycled water from the MRF in conformance with the water quality requirements as provided by Title 22, Division 4, of the California Code of Regulations ("CCR"), section 60305, "Use of Recycled Water for Impoundments," intended as a source of supply for non-restricted recreational impoundments suitable for body contact in compliance with the criteria specified in CCR section 60301.230(b) for "Disinfected Tertiary Recycled Water" (Title 22). VALLECITOS shall use its best good faith efforts to ensure that said recycled water meets the forgoing CCR Title 22 standards, however, VALLECITOS does not guarantee or warrant the quality of the recycled water provided CARLSBAD or subsequent users. Both Parties understand that the presence of dissolved minerals in the recycled water is measured as total dissolved solids (TDS) and other substances in higher concentrations can be deleterious to the plants irrigated with such water. Both Parties agree that VALLECITOS' failure to supply recycled water with TDS concentration of less than 1000 milligrams per liter (MG/L), as determined in conformance with the methodology specified in the Encina Waste Pollution Control Facility Waste Discharge Permit, will be grounds for CARLSBAD to suspend its obligation to accept and pay for recycled water from VALLECITOS until quality is restored to less than 1000 MG/L TDS.

VALLECITOS agrees to limit the total chlorine residual to 10 parts per million (ppm) or less, based upon a 24 hour period average, for recycled water discharged from the MRF. This limitation shall not be applicable to water discharged to the VALLECITOS Failsafe pipeline.

The Parties further recognize that during periods of drought VALLECITOS may experience lower flow as a result of conservation efforts. However, the amounts of salts received would not decrease and can cause the TDS levels to rise. During such drought periods as designated by the Metropolitan Water District ("MWD") and/or the San Diego County Water Authority ("Water Authority"), the Parties agree that recycled water with TDS

concentration of no more than 1200 MG/L will be an acceptable quality to CARLSBAD under the terms of this Agreement.

11. Recycled Water Delivery Pressure. Recycled water delivered by VALLECITOS to the CARLSBAD distribution system shall not be at a guaranteed minimum pressure. However, the following hydraulic grade line ("HGL") shall be met for recycled water discharges from the MRF to the Mahr Reservoir facility. Discharge pressure for delivery at the Mahr Reservoir shall be equivalent to a minimum HGL of 550 feet, including all pipeline headloss, with an operational HGL goal of 590 feet to maximize operational flexibility.

12. Compliance With Regulatory Requirements. CARLSBAD agrees to comply with all applicable recycled water distribution regulations issued and/or mandated by the State of California Department of Health Services (DHS), the County of San Diego Department of Environmental Health (DEH), and the California Regional Water Quality Control Board, San Diego Region (Regional Board). CARLSBAD shall be responsible for insuring that all users of recycled water within CARLSBAD's jurisdiction shall be in compliance with CARLSBAD's discharge order issued by the Regional Board, and that all users shall be made to comply with CARLSBAD's most recent recycled water rules and regulations.

13. Price of Recycled Water. Through Fiscal Year 2003/2004, CARLSBAD shall purchase, disinfected tertiary recycled water from VALLECITOS at the rate of Three Hundred Sixty-One Dollars ($361.00) per acre-foot, and CARLSBAD shall pay VALLECITOS for the recycled water based on quarterly statements submitted by VALLECITOS. Beginning Fiscal Year 2004/2005 the purchase cost shall be based on the table for Pre-Expansion Annual Cost for the MRF Tertiary Facilities listed in Exhibit "C". Upon completion of the MRF expansion, and initial delivery of 3 MGD to CARLSBAD,

CARLSBAD shall purchase, in accordance with section 8(b), disinfected tertiary recycled water from VALLECITOS using the table for Post-Expansion Annual Cost for MRF Tertiary Facilities listed in Exhibit "C." CARLSBAD shall pay VALLECITOS the annual cost in twelve (12) equal payments throughout each fiscal year. Both the Pre-Expansion and the Post-Expansion Annual Costs shall be based on VALLECITOS' budgeted figures as of the beginning of each fiscal year and adjusted to actual costs through retrospective adjustments after the conclusion of each fiscal year. The recycled water cost shall be adjusted on July 1 of each year during the term of this Agreement to reflect CARLSBAD'S proportionate share of the budgeted operational, overhead, and capital recovery costs for the MRF Tertiary Facilities, Lift Station No. 1, and Mahr Reservoir as shown in Exhibit "C". VALLECITOS will provide CARLSBAD thirty (30) days' advance written notice of any changes in the annual cost. VALLECITOS will bill or credit CARLSBAD annually for retrospective adjustments to reflect actual water delivery costs incurred. CARLSBAD will be notified of the retrospective adjustment by November 30 of each fiscal year and the adjustment credit/invoice shall be due and payable within 30 days of said date. At any time during the term of this agreement, the price of the recycled water shall not exceed seventy-five percent (75%) of CARLSBAD'S wholesale cost of potable water from the San Diego County Water Authority.

The definitions for terms used in this section 13 and Exhibit "C" follow:

MRF Facilities – Wastewater treatment, filtration, disinfection, conveyance, storage and effluent pumping facilities shown on Exhibit "B". Also known as Meadowlark Reclamation Facility (MRF).

MRF Tertiary Facilities – Filtration, disinfection, and effluent pumping facilities relating to Tertiary Treatment at the MRF.

Mahr Reservoir – A 54 million-gallon earthen reservoir used to store tertiary treated recycled water located as shown on Exhibit "B".

Lift Station No. 1 – Components associated with the existing lift station used to divert sewage to the MRF for treatment and production of recycled water.

Overhead – Wastewater Department Overhead – General, administrative and overhead costs incurred within the Wastewater Department not directly associated with the collection, conveyance and treatment of wastewater.

Pre-Expansion Cost – This includes all costs associated with the operation and maintenance of the MRF Tertiary Facilities, Lift Station No. 1, Mahr Reservoir and identified capital recovery costs, shown in Exhibit "C" under the title "Pre-Expansion Annual Cost."

Post-Expansion Cost – This includes all costs associated with the operation and maintenance of the MRF Tertiary Facilities, Lift Station No. 1, Mahr Reservoir and capital recovery costs shown in Exhibit "C" under the title "Post-Expansion Annual Cost." These costs will apply after VALLECITOS has begun the initial delivery of 3 mgd to CARLSBAD.

14. Terms of Payment. CARLSBAD shall be invoiced by VALLECITOS on a monthly basis for the minimum delivery scheduled amounts plus any amounts that exceed the minimum amounts. CARLSBAD agrees to pay VALLECITOS for such purchases within thirty (30) days of invoice receipt. In the event that payment is more than thirty (30) days in arrears, VALLECITOS reserves the right to stop delivery of recycled water until payment is made and charge interest of one percent (1%) per month on delinquent amounts.

15. Right to Sell to Others/Utilization of Storage. In the event CARLSBAD fails to purchase the minimum quantities of recycled water as required in section 8 of this Agreement, VALLECITOS shall have the absolute right and discretion to sell the unused recycled water to other parties. Any amounts sold by VALLECITOS to other parties shall be deducted from any remaining amounts that CARLSBAD is obligated to purchase pursuant to section 8 of this Agreement. In addition, in the event CARLSBAD fails to purchase the minimum quantities of recycled water as required in section 8 of this Agreement, all rights of CARLSBAD to utilize storage in the Mahr Reservoir shall revert to VALLECITOS and VALLECITOS shall have no obligation or liability to reimburse CARLSBAD for the cost of the Improvements. Provided, however, in the event VALLECITOS willfully refuses to provide recycled water to CARLSBAD, when available, prior to complete depreciation of the Improvements identified in section 1 "Construction of Improvements," VALLECITOS shall reimburse CARLSBAD for the lesser of the fair market value or the undepreciated value of the Improvements. In the event VALLECITOS uses or sells recycled water to additional parties, VALLECITOS will reimburse or credit CARLSBAD with up to forty percent (40%)of the cost of the improvements, based upon a ratio of water sold to CARLSBAD and total sales, of the annual depreciated value of the Improvements identified in Section 1 based upon a thirty (30) year useful life. The reimbursement or credit shall be in accordance with the annual review of the price of the recycled water in accordance with Section 13.

16. Access to Records. The Parties shall each keep proper books and records in which complete and correct entries shall be made of all recycled water delivered to CARLSBAD throughout the duration of this Agreement. These books and records shall, upon written request, be subject to inspection by any duly authorized representative of each party and of the Regional Board.

17. Notices. Notices required or permitted under this Agreement shall be given in writing and may either be served personally upon the party to whom it is directed or by deposit in the United States Mail, postage pre-paid, certified, return receipt requested, addressed to the Parties' following addresses:

CARLSBAD: Carlsbad Municipal Water District
1635 Faraday Avenue
Carlsbad, CA 92008
Attention: Public Works Director

VALLECITOS: Vallecitos Water District,
201 Vallecitos de Oro
San Marcos, CA 92069
Attention: General Manager

18. Assignment. This Agreement or any interest therein or any monies due or that are to become due thereunder shall not be assigned, hypothecated, or otherwise disposed of without the prior written consent of both Parties to this Agreement, which consent shall not be unreasonably withheld. This Agreement shall become effective on the date it is executed by the Parties.

19. Term of Agreement. The term of this Agreement shall be twenty-two (22) years from the effective date, subject to the rights of the Parties to an earlier termination as provided in this Agreement. This Agreement shall continue in force from year to year after the initial 22-year term until either party gives one (1) year's written notice to the other of its intention to terminate or renegotiate the Agreement. This Agreement shall terminate one (1) year from the date upon which such written notice is received unless the Parties agree otherwise in writing.

20. Early Termination. If at any time during the term of this Agreement recycled water in compliance with the standards referenced herein cannot lawfully be used by CARLSBAD for the purposes intended by this Agreement, because of government

regulations now in effect or hereinafter imposed, or, if CARLSBAD should for any reason breach its obligations under this Agreement in any material respect, including, but not limited to, failure to pay for recycled water as required, failure to accept recycled water as required, failure to maintain facilities, or other substantial failure, VALLECITOS may terminate this Agreement with no further obligation by giving sixty (60) days' written notice thereof to CARLSBAD. During said sixty (60) day period, CARLSBAD shall have the opportunity to cure the breach in the Agreement before termination occurs. In the event VALLECITOS refuses to deliver recycled water to CARLSBAD in conformance with this Agreement for any reason, CARLSBAD may terminate this AGREEMENT with no further obligation upon sixty (60) days' written notice thereof to VALLECITOS.

21. Entire Agreement. This Agreement constitutes the entire understanding between the Parties with respect to the subject matter hereof superseding all negotiations, prior discussions, agreements, and understandings, written or oral, including the 1991 agreement. This Agreement shall not be amended, except by written consent of the Parties, and no waiver of any rights under this Agreement shall be binding unless it is in writing signed by the party waiving such rights. In the event any provision of this Agreement shall be held to be invalid and unenforceable, the other provisions of this Agreement shall be held to be valid and binding on the Parties.

22. Binding Effect. This Agreement shall be binding upon the Parties and their respective successors in interest, permitted assigns, executors, administrators, and personal representatives.

23. Indemnification. VALLECITOS agrees, to the fullest extent permitted by law, to indemnify and hold CARLSBAD, its directors, officers, employees, or authorized volunteers harmless from any damage, liability, or cost (including attorney's fees and costs of defense) to the extent caused by VALLECITOS' negligent acts, errors, or omissions in

the performance of work pursuant to this Agreement, including such negligent acts, errors, or omissions by subcontractors or others for whom VALLECITOS is legally liable. CARLSBAD agrees, to the fullest extent permitted by law, to indemnify and hold VALLECITOS, its directors, officers, employees, or authorized volunteers harmless from any damage, liability, or cost (including attorney's fees and costs of defense) to the extent caused by CARLSBAD's negligent acts, errors, or omissions in the performance of work pursuant to this Agreement including such negligent acts, errors, or omissions by subcontractors or others for whom CARLSBAD is legally liable.

24. Venue. In the event of any legal or equitable proceeding to enforce or interpret the terms or conditions of this Agreement, the Parties agree that venue shall lie only in the courts in or nearest to the North County Judicial District, County of San Diego, State of California.

25. Counterparts. This Agreement may be executed in any number of counterparts, each of which shall be deemed an original, but all of which, taken together, shall constitute one and the same instrument.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed and effective as of August 20, 2003.

"VALLECITOS":

VALLECITOS WATER DISTRICT

By: Trish Hannan
Trish Hannan
President

ATTEST:

General Manager

Date: 8/20/03

APPROVED AS TO FORM:

Jeffrey G. Scott, General Counsel

"CARLSBAD":

CARLSBAD MUNICIPAL WATER DISTRICT

By: Claude "Bud" Lewis
Claude "Bud" Lewis
President

ATTEST:

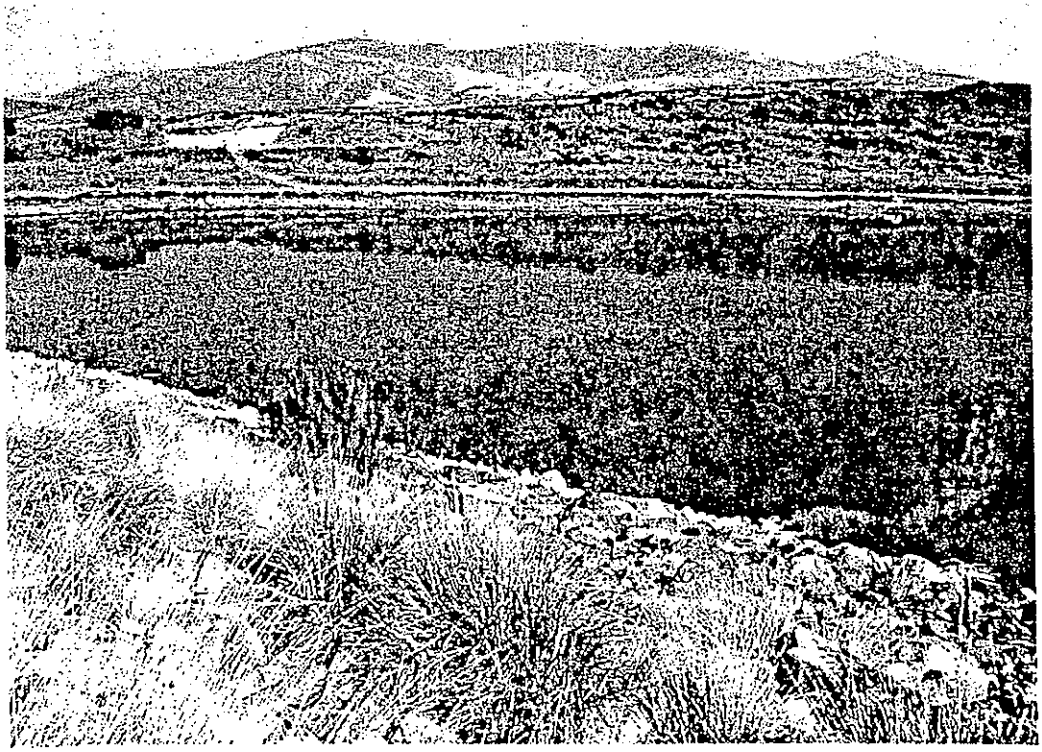
Board Secretary

Date: August 10, 2003

Julia Coleman
Ronald R. Ball, General Counsel
BY: DEPUTY CITY ATTORNEY

Carlsbad Municipal Water District

Preliminary Design for the
Encina Basin Phase II Recycled Water Distribution System



MAHR RESERVOIR EVALUATION

CATHCART GARCIA VON LANGEN
CGVL ENGINEERS

in Association with

POWELL
John Powell & Associates, Inc.
Consulting Civil Engineers

May 2000

Exhibit "A"

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Chapter 1 Background

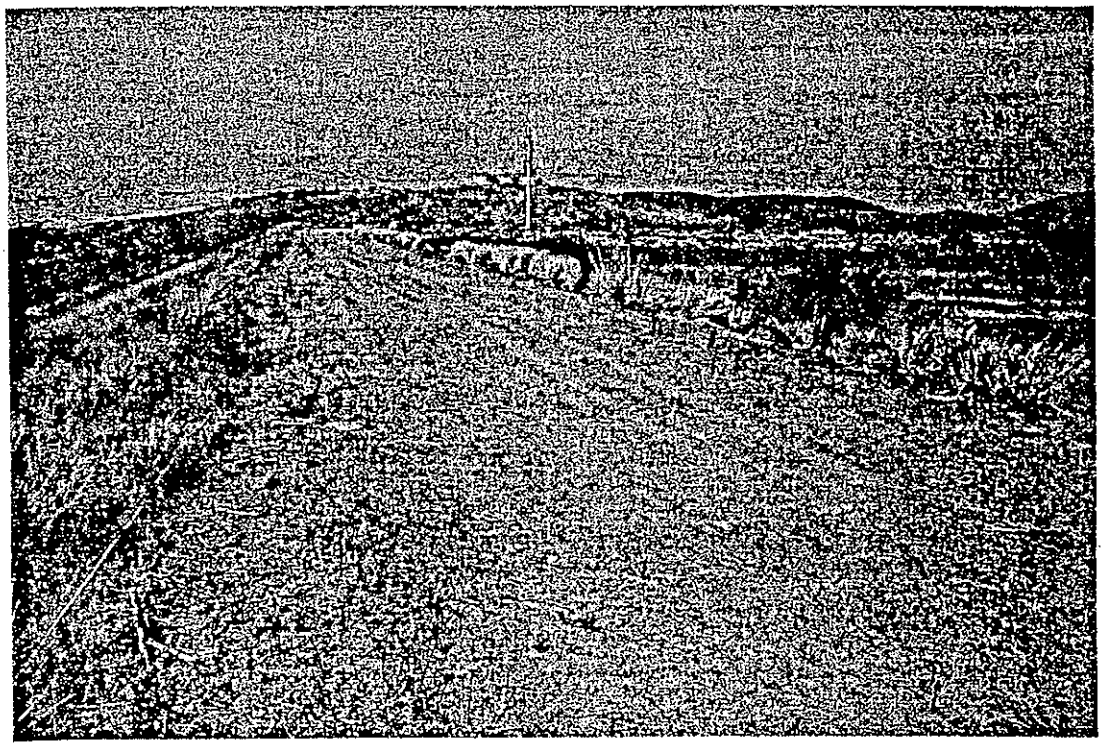
Carlsbad Municipal Water District (CMWD) desires to evaluate the feasibility of using Mahr Reservoir for seasonal storage in CMWD's recycled water distribution system. This evaluation's purpose is to investigate mitigation for historical reservoir operational problems, analyze the effect of this storage volume at various system expansion milestones, evaluate specific reservoir improvements and determine the best combination to pursue, provide an opinion of probable cost, and recommend a course of action for implementation.

Mahr Reservoir Physical Properties

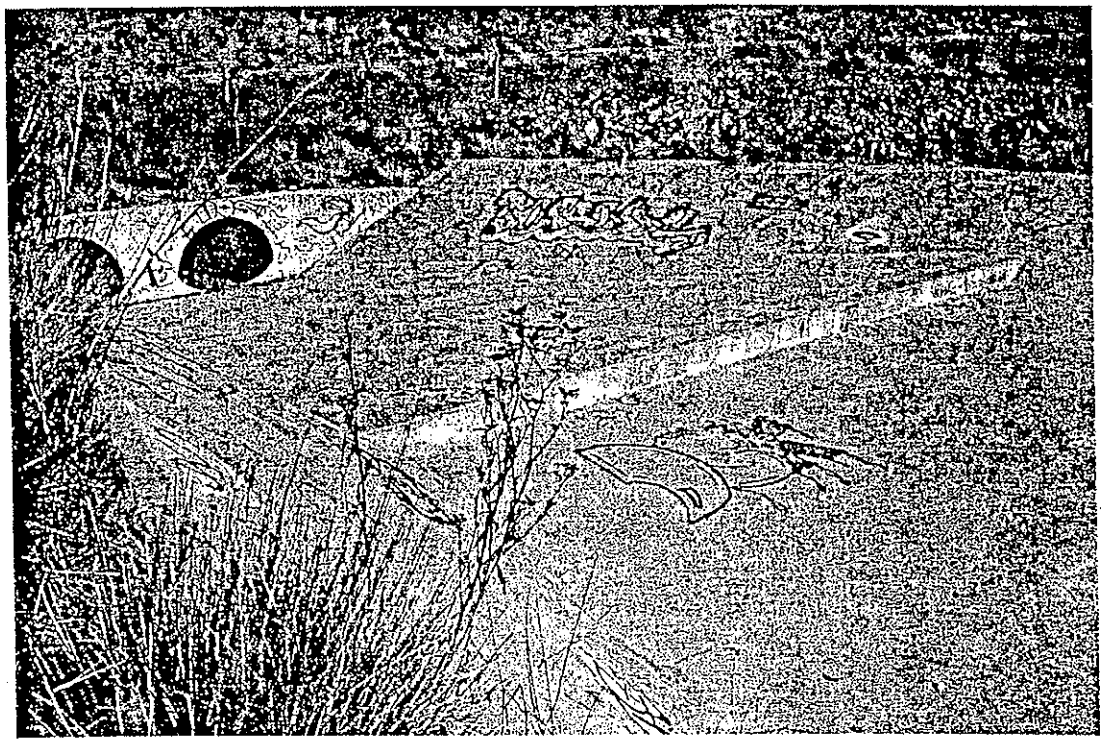
Mahr Reservoir is owned and operated by Vallecitos Water District (VWD). The reservoir is an unlined and uncovered basin formed by a jurisdictional earthen dam, with a crest elevation of approximately 598.5 feet. The reservoir bottom was originally established at approximately 542.5 feet and the spillway elevation is at approximately 594.5 feet. Possibly to allow for storm retention, the maximum operating pool was set in the original facility design at approximately 593.0 feet. For this evaluation, to allow for continued submergence of a possible aeration/destratification system, and to avoid water quality problems associated with shallow storage volumes, a minimum operating pool was set at approximately 555.0 feet, which would maintain a minimum water depth of approximately 12.5 feet.

The effective working storage volume associated with the difference between the maximum and minimum pools is approximately 151 acre-feet (AF), or approximately 49 million gallons (MG). The water surface area at maximum pool depth is approximately 7.7 acres. Figure 1-1 provides recent photos of the reservoir dam crest and spillway. Figure 1-2 provides reservoir volume and area curves in relation to water depth, expressed as feet of elevation above mean sea level (amsl).

Inflow and outflow occur through a concrete structure located near the reservoir bottom at the upstream dam toe. This structure has grated, unvalved ports, and is serviced by an 18-inch diameter pipeline that passes underneath the dam and connects with another concrete structure at the downstream dam toe.

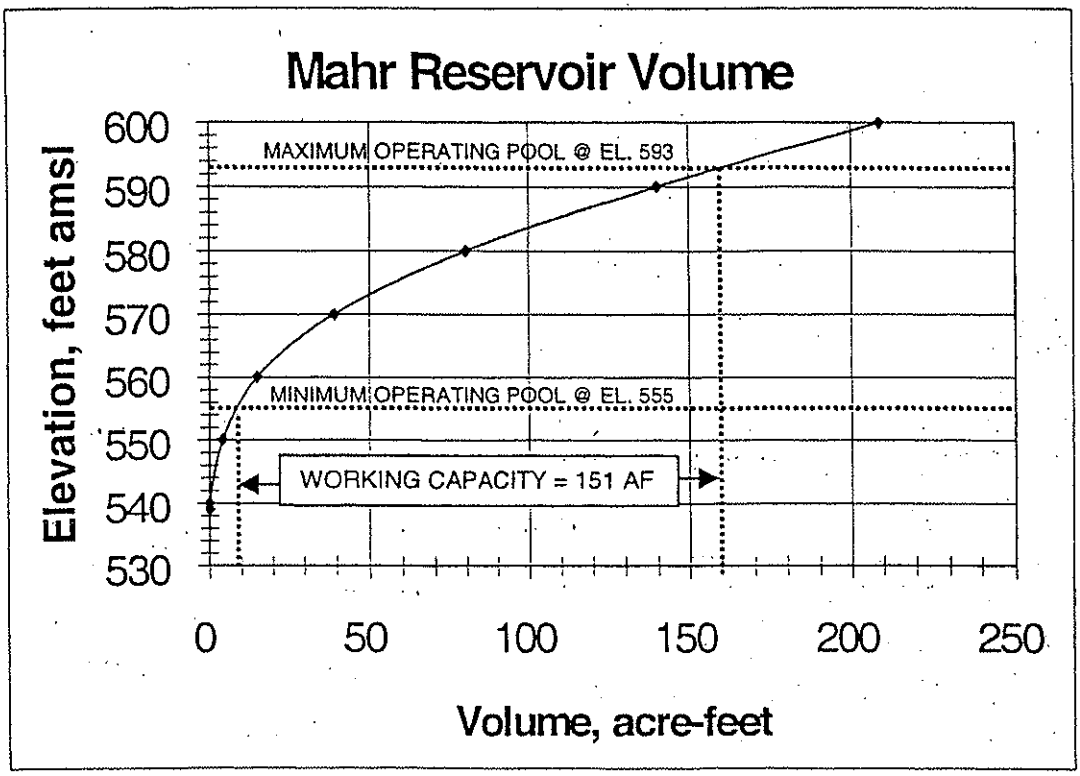


Dam crest, looking north.



Dam spillway, looking northeast.

Figure 1-1 Mahr Reservoir Features



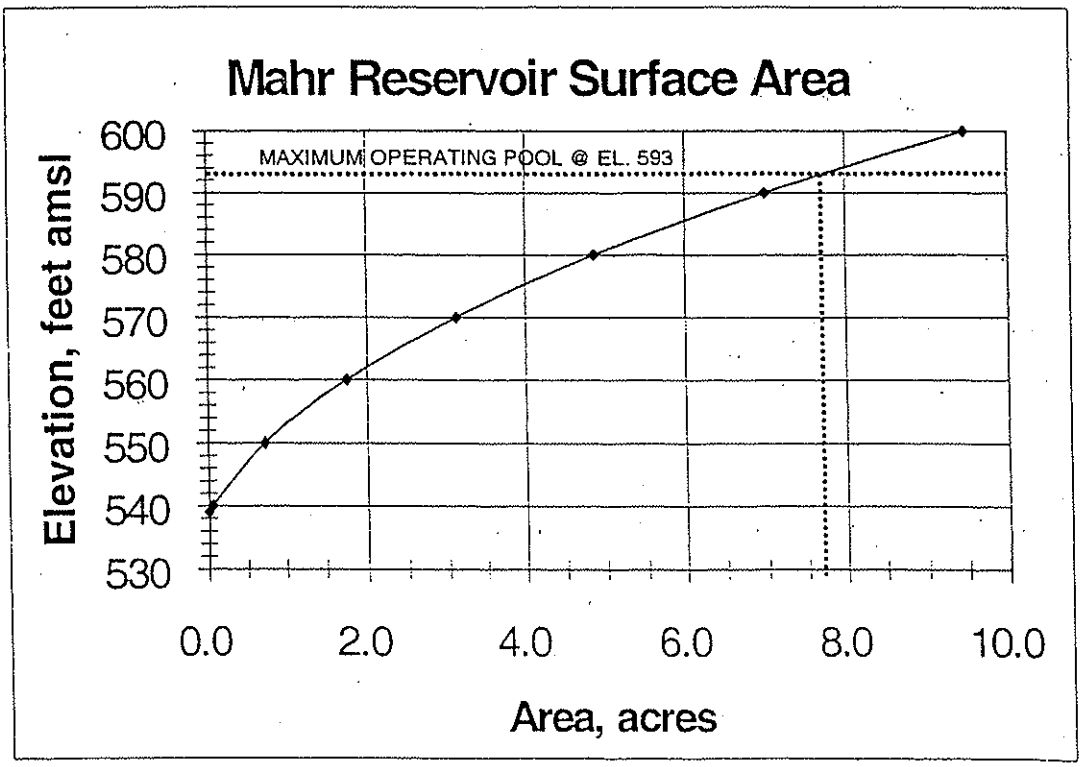


Figure 1-2 Mahr Reservoir Volume and Surface Area Curves

Mahr Reservoir Operational Issues

Ongoing water quality problems experienced by VWD prompted installation of fine screens and implementation of associated procedures at their Meadowlark Water Reclamation Facility (WRF) for treatment of all water withdrawn from the reservoir. Historically, during normal operation, effluent from the WRF was pumped to Mahr Reservoir. Outflow from Mahr Reservoir flowed by gravity through a 20-micron microscreen to remove algae before it was pumped again into the recycled water distribution system. Microscreen effluent could then either flow through a chlorine contact tank or directly into the recycled water distribution system pumping station wet well. However, because of continued odor and algae complaints by recycled water customers, with Mahr Reservoir as the suspected source, the reservoir was taken out of service in 1998. Since that time there have been no further complaints regarding odors and algae.

Other Seasonal Storage Reservoirs

As a basis for comparison, this evaluation reviewed design features and operating histories of other recycled water seasonal storage reservoirs with volumes approximately equal to or greater than Mahr Reservoir's. However, relatively few such seasonal storage reservoirs exist. Three of them are located in Orange County. Sand Canyon and Rattlesnake Reservoirs are owned and operated by Irvine Ranch Water District (IRWD), and have total volumes of 800 AF and 1,200 AF, respectively. Upper Oso Reservoir is owned and operated by Santa Margarita Water District (SMWD), and has a total volume of 4,000 AF. All three reservoirs have been in recycled water service for over 20 years.

The City of Santa Rosa, located in northern California, owns and operates several recycled water storage reservoirs. The largest has a volume of 2,000 AF and has been in service for approximately 16 years. Their next two largest reservoirs have volumes of 1,100 AF and 700 AF, respectively, and have been in service for approximately 22 years. All three reservoirs have relatively flat bottoms, with an average water depth, when full, of 24 to 25 feet. All three reservoirs are surrounded by man-made berms, with virtually no tributary drainage area. For this evaluation, these three reservoirs are designated Santa Rosa A, Santa Rosa B, and Santa Rosa C, respectively.

In discussing design and operation of these reservoirs with respective agency staff, several features emerge for possible application at Mahr Reservoir:

- Relative size and watershed management of upstream tributary area
- Average water depth of full reservoir
- Combination of treated wastewater with other water supplies
- Nutrient removal from treated wastewater
- Use of multiple-port inlet/outlet (I/O) works

- Use of an aeration/destratification system
- Chlorination of reservoir outflow
- Other treatment of reservoir outflow
- Use of basin lining and covering

Table 1-1 presents a matrix of these features, listed in the same order, and their involvement at the six above-noted, existing seasonal storage reservoirs. One of the most significant features to emerge in this evaluation appears to be the relative size and watershed management of upstream tributary area. By far the most problematic in this regard of the three reservoirs that have significant tributary area is Sand Canyon Reservoir. Runoff from a large upstream tributary area carries in fine, colloidal material and algal nutrients, difficult to treat in reservoir outflow. Upper Oso Reservoir appears least problematic in this regard of the three. The ratio of tributary area to total reservoir volume for Sand Canyon Reservoir is approximately ten times larger than Upper Oso Reservoir's ratio. Mahr Reservoir, like the three Santa Rosa reservoirs, has almost no upstream tributary watershed area.

Table 1-1 Other Seasonal Storage Reservoir Features

Feature	Sand Canyon	Rattle-snake	Upper Oso	Santa Rosa A	Santa Rosa B	Santa Rosa C
Tributary watershed area	Large	Small	Small	None	None	None
Average water depth	15[a] ft	15[a] ft	30 ft	25 ft	24 ft	24 ft
Combined with other supplies	No	Yes	No	No	No	No
Nutrient removal at plants	Minor[b]	Minor[b]	No	Minor[c]	Minor[c]	Minor[c]
Multiple port I/O works	Yes	Yes	Yes	Yes	No[d]	No[d]
Aeration/Destratification	Yes[e]	No[f]	Yes	No	No	No
Chlorination of outflow	Yes[g]	Yes[g]	No	No	No	No
Other treatment of outflow	Yes[h]	No[i]	No[i]	No	No	No
Basin lining and covering	No	No	No	No	No	No
General problem history	Yes	No	No	No	No	No

a) Estimated.
b) Partial nitrification/denitrification practiced at IRWD's Michelson Water Reclamation Plant, but not primarily for reservoir water quality.
c) Partial nitrification/denitrification practiced at Santa Rosa reclamation plant for last few years, but primarily motivated by regulatory requirement for winter river discharge.
d) Have some turbidity problems with single port and seasonally low water levels.
e) System installed in 1999 with successful performance.
f) Water quality tends to be good without aeration, but installation will be evaluated in 2000.
g) Initially practiced for chemical oxidation of sulfides; later continued partially to maintain a chlorine residual in the associated distribution system.
h) Have tried several types of relatively expensive filtration systems, with varied success.
i) Have only occasionally used Adams strainers.

The other significant feature to emerge in this evaluation appears to be the average water depth of a reservoir when full. Santa Rosa staff reported no significant algae growth or other depth-related water quality problems when water depths were predominantly greater than about 8 feet. This meant their three largest reservoirs only suffered problems on the occasions when they were drained to within a few feet of their bottoms. Their two smaller reservoirs (not noted above), with volumes of approximately 200 to 300 AF, have average depths of about 4 feet and have been regularly plagued with algae and related water quality problems. The City has employed algae harvesters and barrel filters to mitigate these problems, with moderate success after considerable effort. Mahr Reservoir's average water depth when full is about 25 feet, and the planned minimal pool depth is 12.5 feet.

Application of the above considerations is explicitly made to Mahr Reservoir in Chapter 4.

Chapter 2
Basis of Evaluation

Design criteria and basic cost data presented herein apply to concept and preliminary level design and layout of recycled water system components. Detailed drawings and specifications are not required in such layouts. For this level, a close approximation of size, location, and cost of various facilities is developed. As a result, some relocation and resizing of facilities may be required at a later date as more detailed engineering analyses are made during final design.

Facility sizing is based on future recycled water requirements listed and developed in Chapter 3. Criteria and standards governing design of proposed facilities are assumed to use quality design, materials, and construction. Further, it is assumed that proper attention will be given to considerations such as appearance, landscaping, operation and maintenance efficiency, and service reliability. In planning future facility needs, an effort has also been made to effectively use existing components where practical.

Proposed facilities described in this evaluation are planned as component parts of a system to serve the projected recycled water requirements of CMWD's proposed Phase II expansion to a system demand of approximately 5,400 acre-feet per year (AFY). Some attention is also given to those improvements required for ultimate expansion to a system demand of approximately 9,800 AFY.

Facility Sizing Criteria

Demand Criteria. Monthly demands are used to determine seasonal supply and storage needs for the recycled water system. The ratio of peak-month to average-month demand, or peak-month factor, is ultimately used in determining pumping and operational storage capacities.

Hourly demands are directly used in determining pumping, operational storage, and pipeline capacities, and are determined by the average-day use during the peak month, multiplied by the ratio of 24 hours over the length of the regular daily irrigation period in hours. For example, in calculating peak-hour demands, the peak-month factor would be multiplied by two if a 12-hour irrigation period is assumed, or multiplied by three if an 8-hour irrigation period is assumed.

System Pipeline Criteria. System piping should be evaluated under all demand conditions, but performance assessment is typically most critical under peak-hour demand conditions. Generally, pipelines 12-inch and greater in diameter are considered transmission pipelines. Because transmission pipelines impact large areas, they can accumulate large head losses from long pipe runs. These large pipeline friction losses associated with high fluid velocities need to be evaluated with respect to system delivery capacity, and contribution to lowered system pressures and excessive energy consumption.

Transmission pipelines are considered undersized if water velocities exceed 3 feet per second (fps) and head losses exceed 10 feet of head per 1,000 feet of pipe. Distribution pipelines are considered undersized if velocities exceed 5 fps and head losses exceed 10 feet of head per 1,000 feet of pipe. However, these criteria are only a guideline, and higher velocities and head losses may be tolerable under certain operating conditions such as system emergencies, and within short lengths of pumping station or reservoir yard piping where impact on system pressure is minimal.

Project Cost Data

Project cost is defined as the total capital investment necessary to complete a project, including costs for land acquisition, construction, contingencies, all necessary engineering services, and overhead items such as legal and administrative services, and financing. Probable construction cost opinions developed in this report include an allowance of 20 percent for contractor administrative expense, general overhead and profit (OH&P). Total project capital cost includes allowance for contingencies at 20 percent, and engineering and administration at 15 percent.

Construction Costs. Probable construction cost opinions cover materials, taxes, labor, mobilization/demobilization, and services necessary to build proposed facilities. These costs derive from current or adjusted historical cost information and are intended to represent median prices anticipated for each type of work. Cost estimating guides, previous studies, cost curves, and recent contract bids were used to develop cost information.

In an evaluation such as this, cost opinions are considered as defined by the American Association of Cost Engineers for preliminary design. These are opinions made without detailed engineering data and have an expected accuracy range of plus 30 percent to minus 20 percent. Actual project costs will depend on future labor and material costs, market conditions, project-specific details, and other variables. The allowance of 20 percent for contractor OH&P is calculated from the subtotal of all other construction costs, the addition of which results in the total construction cost.

Cost Index and Price Escalation. Construction costs typically undergo long-term changes in keeping with corresponding changes in the regional and national economy. A commonly accepted barometer of these changes has been Engineering New Record's Construction Cost Index (ENRCCI), which is computed from prices of construction materials and labor, and is based on a value of 100 in the year 1913.

As indicated on Figure 2-1, construction costs have been steadily increasing for many years. This figure shows ENRCCI's aggregate rate of increase for 20 major US cities, which is considered representative of construction costs in the San Diego area and, therefore, in CMWD. Project and construction costs in this report are based on a projected ENRCCI of 6,130 for January 2000 in the San Diego area.

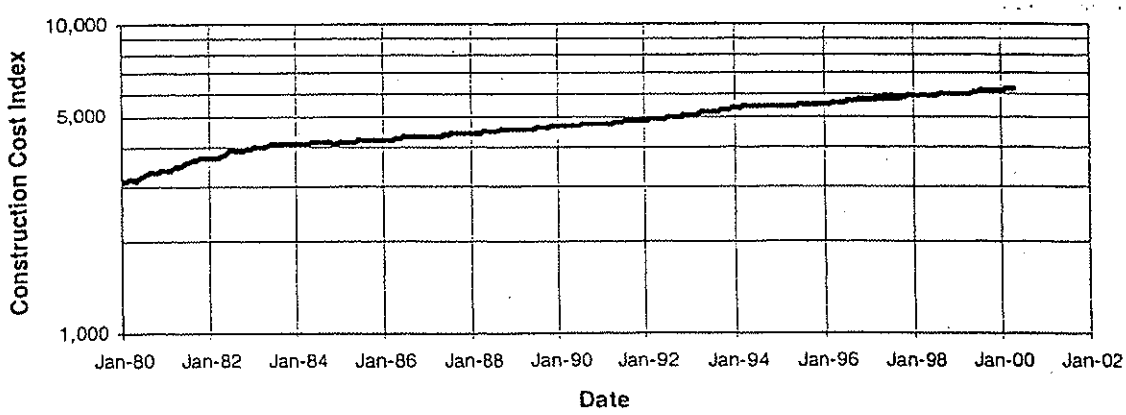


Figure 2-1 Engineering News Record Construction Cost Index

Construction Contingencies. A contingency allowance covers uncertainties associated with project design. Factors such as unusual foundation conditions, special construction methods, variation in final lengths or average depths of pipeline, and construction adjacent to existing facilities are just a few of the many items that may increase construction costs, and for which an allowance is made in preliminary design cost opinions. The cost of these items can vary greatly depending on the type and magnitude of project. An allowance of 20 percent of total construction cost is assumed to cover such contingencies, the addition of which results in the subtotal project cost.

Engineering and Administration. The cost of engineering services for major construction projects includes some or all of the following: special investigations, surveys, foundation explorations, locating interfering utilities, detailed design, preparing contract documents, construction inspection, office engineering, materials testing, final inspection, and start-up of the completed project. Depending on the size and complexity of project, total engineering, legal and administrative costs may range from 7 to 40 percent of the contract cost. The lower percentage usually applies to relatively large projects, simple projects, and

those not requiring a large amount of preliminary investigation. The higher percentage usually applies to smaller projects, projects requiring a great deal of engineering effort, or those requiring a relatively large amount of preliminary work. An allowance of 10 percent of subtotal project cost is assumed for this report.

CMWD administration charges are assumed to cover items such as legal fees, financing expenses, administrative costs and interest during construction. The cost of these items can vary, but for the purpose of this evaluation, administration charges are assumed to equal approximately 5 percent of subtotal project cost. The average total cost of all necessary engineering plus administrative services is therefore assumed to be 15 percent of the subtotal project cost, the addition of which results in the total project cost.

Chapter 3 Supply/Demand/ Storage Analysis

Mahr Reservoir has the potential to provide seasonal, emergency and operational storage for CMWD's recycled water system. The first two storage types are analyzed in this chapter. Operational storage analysis is part of ongoing related work, but outside this evaluation's scope. Results of that analysis and those of this chapter are used in Chapter 5.

Seasonal Storage

Three expansion milestones were selected at which to assess Mahr Reservoir's possible seasonal benefit to CMWD's existing and planned recycled water system:

(1) Current situation, representing an annual system demand of approximately 1,800 AFY
(2) Completion of Phase II, representing an annual system demand of approximately 5,400 AFY
(3) Ultimate expansion, representing an annual system demand of approximately 9,800 AFY

Three CMWD system scenarios were selected to quantify the reservoir's benefit at each milestone:

(A) System supply/demand fully balanced by hypothetical seasonal storage
(B) System supply/demand balanced with no seasonal storage
(C) System supply/demand balanced with Mahr Reservoir working storage

Demands. All scenarios used the same recycled water demand hydrograph, which was developed from the last five complete years of actual CMWD metered demand. A listing of monthly demand values and related statistics for the years 1995 through 1999 is provided in Appendix A. Because the months in which peak and minimum demands occur are not the same from year to year, a simple average of each month, as shown in the second-to-last row of the table in Appendix A, does not result in representative factors for accurately modeling and projecting system demand variations. Rather, it tends to reduce peak demands and increase minimum demands. Therefore, this simple average was adjusted by an algorithm to preserve the true average peak-month and minimum-month factors, which is more representative of historical seasonal fluctuations. This

adjusted average is shown in the last row of the same table. The resulting adjusted peak-month factor of 2.10 is used for subsequent facility analysis.

A unit hydrograph was developed for monthly irrigation demands based on this adjusted five-year system average. Figure 3-1 is a graphical representation of the adjusted hydrograph. Based on these adjusted factors, July has the representative peak-month demand and January has the representative minimum-month demand. This hydrograph is typical of recycled water monthly demand variations and reflects typical southern California irrigation cycles.

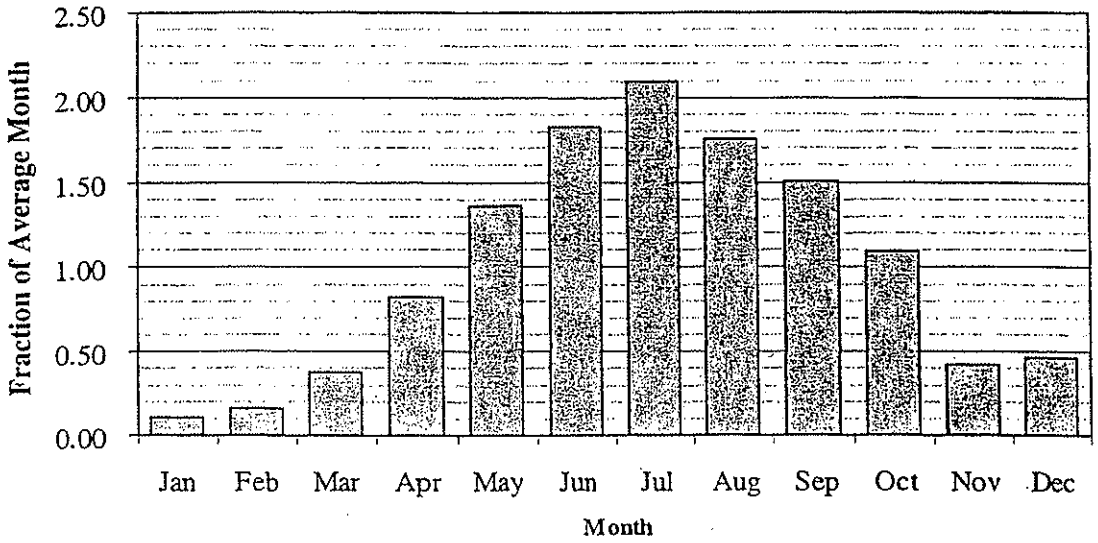


Figure 3-1 CMWD Recycled Water Demand Hydrograph

Supplies. Existing and planned CMWD recycled water supply sources include the following:

- Carlsbad Advanced Wastewater Treatment (AWT) facility, to be constructed by CMWD at the Encina Water Pollution Control Facility (WPCF), owned and operated by the Encina Water Authority
- Meadowlark WRF, owned and operated by VWD
- Gafner Water Reclamation Plant (WRP), owned and operated by Leucadia County Water District

Based on CMWD preferences, for this evaluation it is assumed that production capacities of these plants would be used in the order listed above. Estimated *available* peak-month plant supply capacities in million gallons per day (MGD) and acre-feet per month (AFM) for each of the three milestones are listed in Table 3-1. Calculated *required* plant supply capacities for each scenario, which are sometimes less, are discussed below.

Table 3-1 CMWD Recycled Water Supply Availability

Supply Source	Estimated Peak-Month Availability					
	Current		Phase II		Ultimate	
	MGD	AFM	MGD	AFM	MGD	AFM
Carlsbad AWT	0.00	0	4.00	374	15.0	1,401
Meadowlark WRF	1.70	159	2.00	187	3.0	280
Gafner WRP	0.75	70	2.00	187	2.0	187
Total	2.45	229	8.00	747	20.0	1,868

Seasonal Balancing. A computerized spreadsheet model of CMWD's recycled water system was developed to test monthly supply/demand balances, and the resulting use of seasonal storage. The model was applied to each of the three scenarios at each of the three milestones, for a total of nine analyses. For those analyses using Mahr Reservoir as seasonal storage, reservoir filling was assumed to occur in January and February, the two lowest demand months. Copies of these analyses are found in Appendix B and labeled by milestone and scenario: 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, and 3C.

A critical test for seasonal supply/demand balancing is satisfying peak-month demand, either directly from one or more supply sources, or from a combination of direct supply and water returned from seasonal storage (reservoir outflow). Peak-month results in AF from the nine analyses are summarized in Table 3-2.

Table 3-2 CMWD Peak-Month[a] Supply/Demand Balance

Milestone/ Scenario	Peak-Month Volume, AF[b]						Total Storage Volume, AF
	Demand	Required Supply				From Storage	
		Carlsbad	Meadow.	Gafner	Other[c]		
1 – Current							
A	315	0	150	0	0	165	548
B	315	0	159	70	86	0	0
C	315	0	159	70	16	70	151
2 – Phase II							
A	945	374	76	0	0	495	1,644
B	945	374	187	187	198	0	0
C	945	374	187	187	62	136	151
3 – Ultimate							
A	1,716	817	0	0	0	899	2,983
B	1,716	1,401	280	35	0	0	0
C	1,716	1,401	164	0	0	151	151

a) Peak month assumed to be July, with a peak-to-average-month ratio of 2.10, based on Figure 3-1.
b) Because of round-off, sums of volumes may differ by ±1 AF.
c) Other supply capacity assumed to be supplemented potable water.

In assessing Mahr Reservoir's seasonal benefit to CMWD's system, it is helpful to compare the reservoir with an equivalent peak-month supply source, both in

volume delivered (AF) and equivalent production rate (MGD). The estimated volume delivered from storage by Mahr Reservoir is shown in the second-to-last column for Scenario C under each of the three milestones in Table 3-2. It is also a useful perspective to see what fraction Mahr Reservoir's storage would represent of the total seasonal storage needed to fully balance the recycled water system for each of the three milestones. These data are summarized in Table 3-3.

Table 3-3 Mahr Reservoir Seasonal Benefits to CMWD

Milestone	Peak-Month Supply AF	Equivalent Peak-Month Production Rate MGD	Fraction of Fully-Balanced Storage percent
Current	70	0.75	28
Phase II	136	1.46	9
Ultimate	151	1.62	5

Because of production limitations in planned Phase II Meadowlark WRF and Carlsbad AWT expansions, 62 AF of other supply (probably potable water), in addition to Mahr Reservoir, would be needed to balance peak-month Phase II demands under Scenario 2C.

Emergency Storage

Mahr Reservoir's emergency storage benefit to CMWD's system depends on total recycled water production capacity available, demand on the distribution system, and volume of water in the reservoir, all at the time of the emergency, and time of year. Because of such a wide range of variables, only a sample analysis was performed, using the same computerized spreadsheet model noted above. As an analytical basis, the model was applied to the Phase II milestone Scenario 2C (see Appendix B), in which the routine seasonal filling of Mahr Reservoir occurred in January and February. After an assumed emergency draw-down to offset simulated lost supply in a given month, the model was constrained to refill the reservoir as quickly as possible so to be full in May, leaving the reservoir available to provide its full seasonal storage benefit. The simulated supply loss was constrained to be subsequently offset by recycled water production, up to maximum available rates, without the use of additional potable water supplement (beyond that already estimated for Scenario 2C).

Given these constraints, there were only three months during which the reservoir could provide emergency supply: February, March and April. Three simulations were run, one for an emergency supply loss in each of those three months. Copies of these analyses are found in Appendix C and captioned by volume and month of supply loss, all being labeled Scenario 2D. The following emergency storage (supply loss offset) could be provided by Mahr Reservoir: in February, 149 AF; in March, 151 AF; and in April, 131 AF.

If water were stored in the reservoir—beyond the minimum operating pool volume—over more of the year, say starting in the fall, emergency supply could be available for more months. To maintain the full seasonal benefit discussed in the previous section, no emergency storage would be available May through September. It is important to *correctly condition* emergency storage availability, so as not to inappropriately "double-count" Mahr Reservoir storage for both seasonal and emergency purposes.

Chapter 4
Facility Alternatives

Possible Facility Improvements

Mahr Reservoir's recycled water system benefit accrues both from seasonal and emergency storage value, noted in Chapter 3, and operational storage value, discussed in Chapter 5. To realize these values, facility improvements are required to mitigate known problems. These improvements could occur at the reservoir, or at other locations to affect water quality of reservoir inflow and/or outflow. The following improvements have been considered:

- Removing nutrients from reservoir inflow at the wastewater treatment plants
- Modifying the existing reservoir I/O works, with multiple ports for best seasonal water stratum selection
- Adding an aeration/destratification system in the reservoir
- Adding chlorination to reservoir outflow
- Reusing existing microscreens, either at Meadowlark WRF or relocated to Mahr Reservoir, to remove suspended material from reservoir outflow
- Adding reservoir lining and covering

Wastewater Inflow Nutrient Removal. Phosphorus and nitrogen are macronutrients for algae and other plant growth. Both constituents are typically present in wastewater at concentrations many times higher than growth limiting values. Removing phosphorus from reservoir inflow would typically involve chemical precipitation as part of primary treatment at a wastewater treatment plant. Removing nitrogen would typically involve nitrification/denitrification as part of secondary treatment at a wastewater treatment plant.

While Meadowlark WRF is physically closest to Mahr Reservoir, planned system-wide recycled water production, as illustrated in Chapter 3, projects Carlsbad AWT production to dominate the recycled water blend, even in Phase II. In addition, Gafner WRP's Phase II production is projected to be comparable to Meadowlark WRF's. Therefore, one or both nutrient removal processes would have to be implemented at all three plants to substantially control nutrients.

Each nutrient removal process adds significant cost to a wastewater treatment plant's liquid stream and incidental cost to a plant's solids stream. While substantial nutrient reduction at each plant would help control algae growth in the reservoir, the nutrient loss is a disbenefit to the recycled water system's irrigation

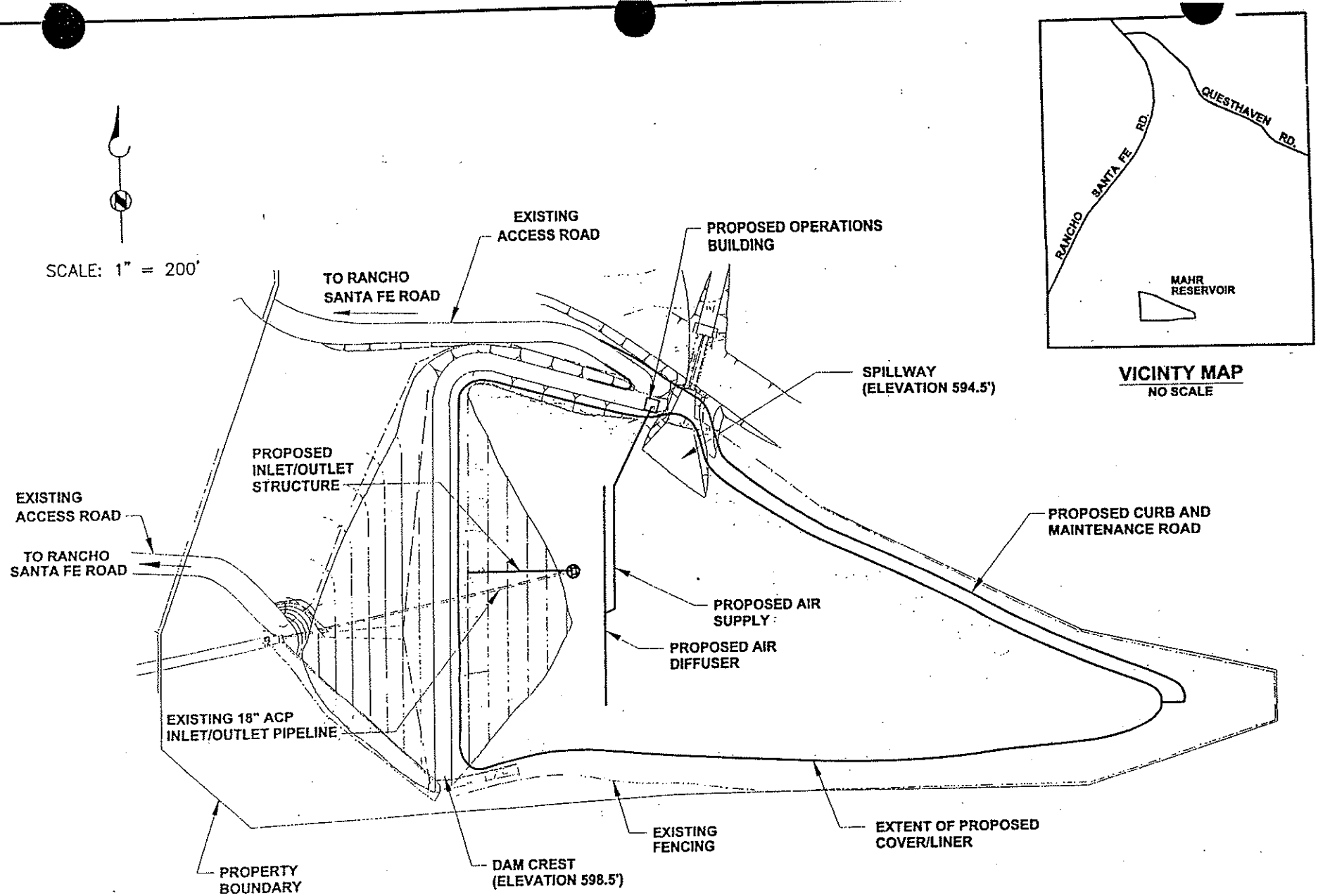
customers. Various studies have valued the typical wastewater nutrient fertilizer "credit" at $40 to $50 per acre-foot. Estimating the precise benefit to the reservoir of a given amount of nutrient removal would require a detailed analysis of the combined plant effluents and water stored in the reservoir. The analysis would then determine limiting nutrient quantities, which typically involve very low concentrations, as treatment process target values. These estimations are beyond this evaluation's scope, and this candidate improvement is not considered further.

Modified I/O Works. The current reservoir I/O works has only one set of openings around elevation 550 feet, only a few feet above the basin bottom. An improved I/O works would have multiple sets of openings, say four additional, equally spaced, approximately 9 feet apart vertically. This would allow selective water withdrawal from the stratum having the seasonally best water quality, e.g., avoiding a layer of algae in the top 5-10 feet of water, and avoiding intake of bottom sediment.

There are two basic I/O works configurations: a free-standing tower rising from the reservoir bottom, and a laid-back structure secured to the upstream dam face. A free-standing tower could in concept be constructed on top of the existing I/O works. A laid-back structure could be connected between the existing I/O works and the toe of the upstream dam face. A review of conceptual design considerations for the two alternatives indicated the latter alternative would be less disruptive, probably less expensive, and therefore, preferable. Either I/O modification would require review by the State of California, Division of Safety of Dams (DSOD). Key consideration by DSOD would be maintaining adequate and controllable reservoir draw-down capability for dam emergencies.

The plan location of the modified I/O works with respect to the existing works and other existing and proposed reservoir features is shown on Figure 4-1. A drawing of a laid-back I/O structure is shown on Figure 4-2. Four I/O port valves would be provided for selecting the best quality water stratum, and an additional valve would isolate the existing works. The latter valve would be normally closed, and this existing opening used as a fifth regular I/O port and as an emergency outlet to satisfy jurisdictional dam draw-down requirements.

Preliminary sizing of I/O works components was based on hydraulic network analyses of proposed CMWD recycled water distribution system expansions, which are represented in the recently completed *Encina Basin Recycled Water Distribution System Study*. Although volumes associated with Mahr Reservoir's operational storage function are relatively small compared with those of seasonal storage, operational storage peak-hour hydraulic requirements should be used to size I/O piping and valves. Table 4-1 lists peak-hour withdrawal rates estimated in the above-noted work for the Phase II and ultimate system expansions. As additional recycled water production capacity and operational storage volumes elsewhere are ultimately developed, the peak-hour demand on Mahr Reservoir's storage decreases from Phase II to the ultimate condition. Hence, the estimated



CATHCART, GARCIA, VON LANGEN

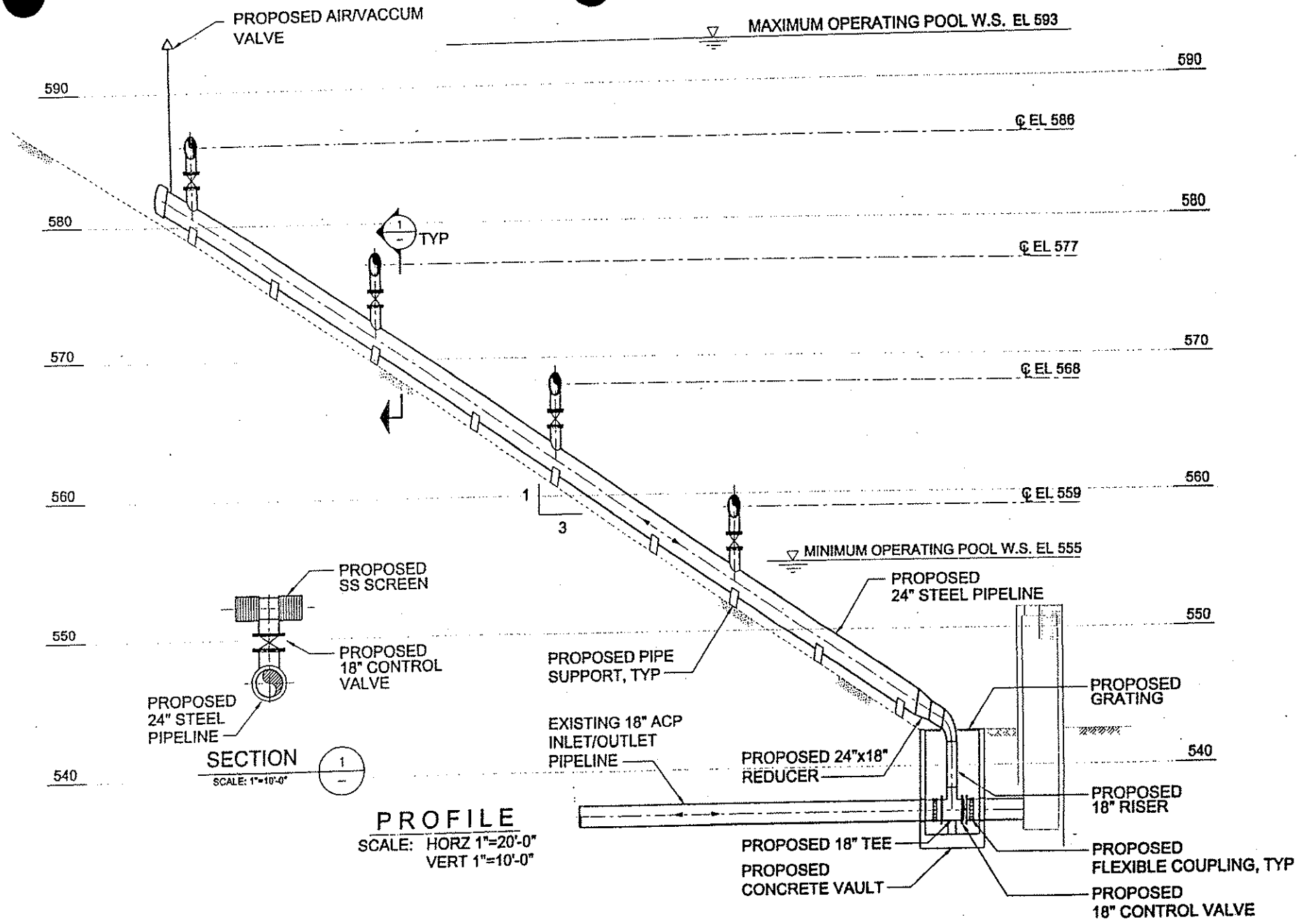
CGvL ENGINEERS

IN ASSOCIATION WITH
JOHN POWELL & ASSOCIATES

CARLSBAD MUNICIPAL WATER DISTRICT

FIGURE 4-1 PROPOSED MAHR RESERVOIR IMPROVEMENTS

05/19/00 at 04:00:48pm P:\207-01\20701-FIG4-1.dwg



6/27/00 at 09:16:09am P:\207-01\20701-FIG4-2.dwg

CAMPBELL CARLSBAD VON LANGEN

CGvL ENGINEERS

IN ASSOCIATION WITH
JOHN POWELL & ASSOCIATES

CARLSBAD MUNICIPAL WATER DISTRICT

FIGURE 4-2 PROPOSED MAHR RESERVOIR I/O WORKS

Phase II peak-hour withdrawal rate is higher than the ultimate rate, and the Phase II rate should be used for I/O works sizing.

Because the runs are short, the existing 18-inch I/O pipeline, which lies under the dam, and proposed extension up the dam face should be considered as distribution pipelines for sizing. As shown in Table 4-1, peak-hour velocities in the existing 18-inch I/O pipeline will exceed normal hydraulic design criteria discussed in Chapter 2. This situation would improve from Phase II to the ultimate condition. The higher velocities could be tolerated in the existing piping, since its replacement or paralleling would be extremely difficult, but the proposed extension to the works should use 24-inch piping, the nearest regular pipe size satisfying hydraulic design criteria.

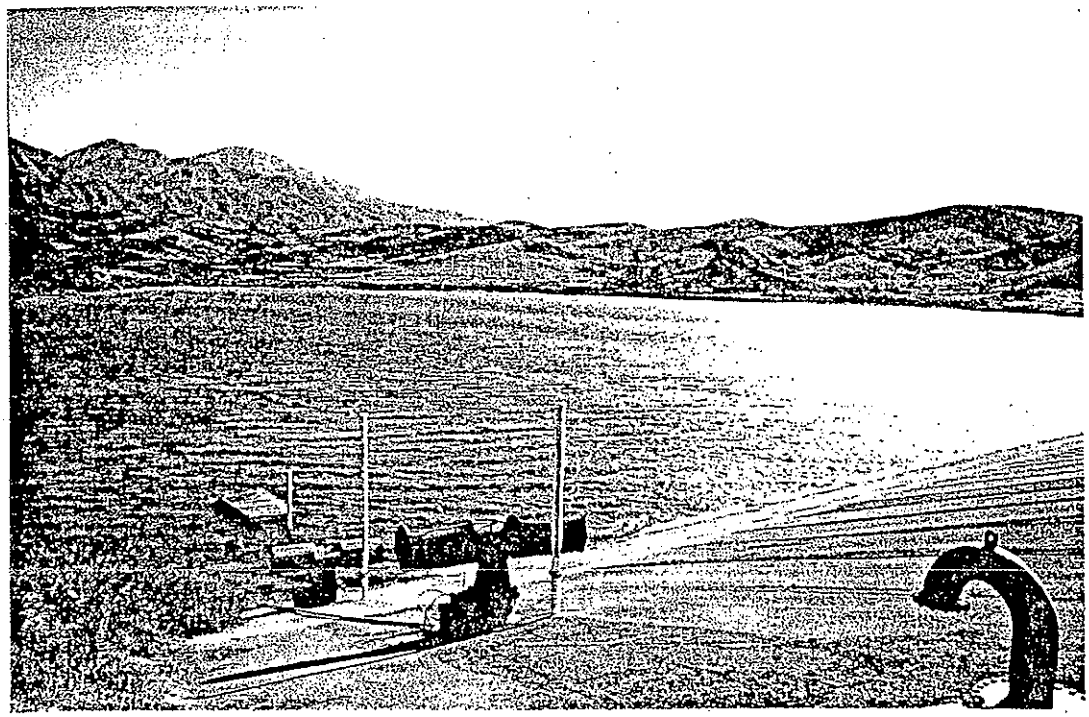
Table 4-1 Mahr Reservoir I/O Hydraulic Parameters

Parameter	Units[a]	Milestone	
		Phase II	Ultimate
Peak-Hour Flow	gpm	7,947	6,473
Based on Existing I/O Pipeline Diameter (18 inches)[b]:			
Pipe Velocity	fps	10.6	8.6
Based on Hydraulic Criteria Diameter (24 inches)[b]:			
Pipe Velocity	fps	5.6	4.6

a) Unit abbreviation: gpm = gallons per minute.
b) Using a friction factor of C = 120.

Because the total headloss difference between a 24-inch and 18-inch valve is relatively small, and the cost difference relatively larger, 18-inch valves are assumed for the four proposed new I/O port controls. Each I/O port would be protected from coarse suspended material by appropriate stainless steel screens. The arrangement of these screens is highlighted on Figure 4-2, and a photograph of similar I/O port screens at SMWD's Upper Oso Reservoir is shown on Figure 4-3. All valves would be hydraulically operated with control lines terminating in a proposed operations building at the reservoir's north side, as shown on Figure 4-1. A probable cost opinion of the modified I/O works is given in Table 4-2.

Aeration/Destratification System. A body of water like Mahr Reservoir, several feet deep or more, will naturally tend to undergo thermal stratification. Because of solar heat load, upper and lower waters tend to become thermodynamically "separate" with respect to uniform mixing. Upper waters tend to stay well mixed and aerobic, while lower waters become stagnant and anoxic. The latter environment, especially with chemicals present in recycled water, can promote hydrogen sulfide and other odiferous chemical production. With CMWD's climate, one stratification cycle per year will occur, with onset in spring, greatest stratification in late summer, natural mixing or "turnover" in fall, and well-mixed water in winter.



Upper two I/O ports, looking east.

Figure 4-3 Upper Oso Reservoir I/O Works

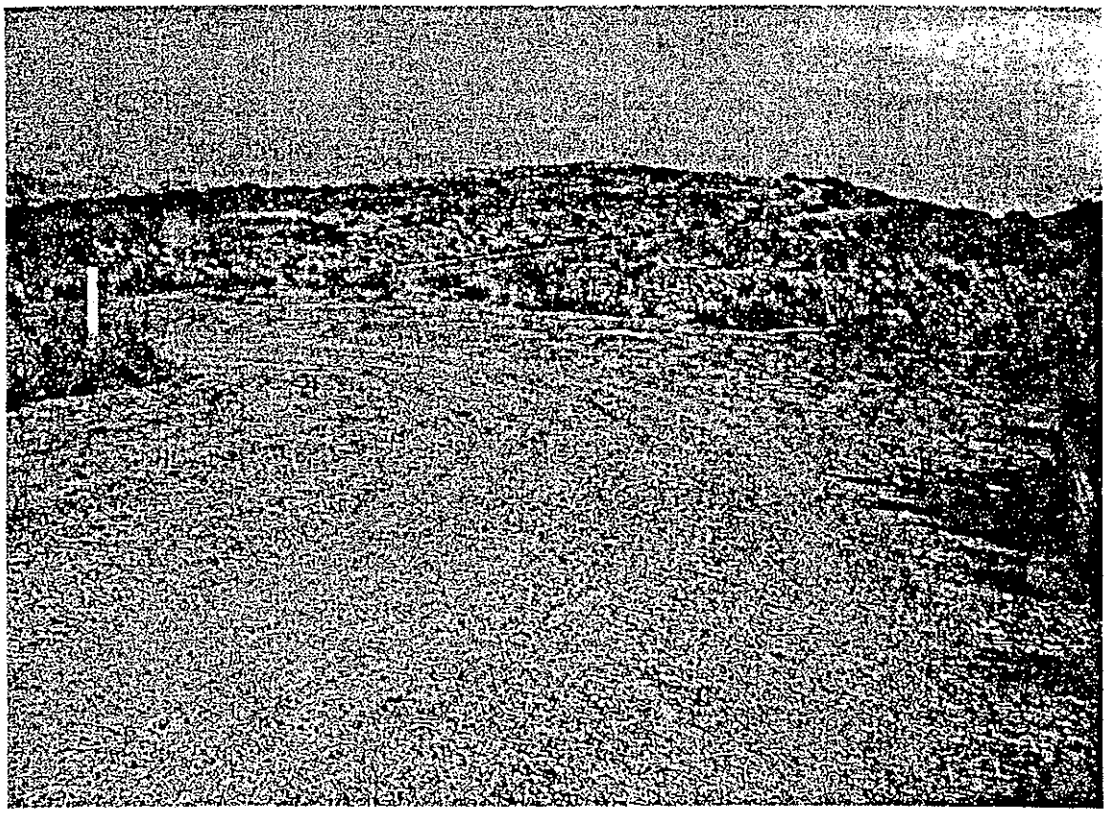
An aeration system can perform substantial mixing of the reservoir volume and provide supplemental oxygen. This mixing can prevent or eliminate stratification, and its undesirable consequences, and even help control certain algae growth. Typical Southern California experience shows the system only needs to operate part of the day or a few days a week, and only during the spring-to-fall half of the year.

A common system configuration, used in several reservoirs and lakes in San Diego and Orange Counties, includes an air compressor, usually housed in a small building for protection and sound attenuation; an air supply pipeline; and a diffuser pipeline, usually located 5-10 feet above the bottom near the deepest portion of the basin. Keeping this diffuser pipeline well submerged is one reason to establish a 12.5-foot deep minimum operating pool, discussed in Chapter 1. The operations building noted above could house both the I/O works valve controls and the aeration/destratification system's compressor. Location of these features is shown on Figure 4-1. A photograph of the proposed operations building site is provided as Figure 4-4.

Table 4-2 Cost Opinion for Mahr Reservoir I/O Works

Item	Quantity		Material Cost dollars		Labor Cost dollars		Total Cost dollars[b]
	No.	Unit[a]	Unit	Total	Unit	Total	
Demolition Work	1	LS	0	0	20,000	20,000	20,000
Concrete Vault							
Excavation	33	CY	40	1,320	20	660	1,980
Backfill	16	CY	40	640	20	320	960
Concrete	10	CY	200	2,000	400	4,000	6,000
Shoring	5	ton	600	3,000	360	1,800	4,800
24-Inch Steel Pipe w/Epoxy Coating	140	ft	115	16,100	105	14,700	30,800
Welding Joints	30	each	315	9,450	33	990	10,440
18x18x18-inch Tee w/Epoxy Coating	5	each	900	4,500	982	4,910	9,410
18-inch 90-degree Elbows w/Epoxy Coating	1	each	950	950	769	769	1,719
24x18-inch Reducer w/Epoxy Coating	1	each	680	680	763	763	1,443
24x24x18-inch Tee w/Epoxy Coating	4	each	1,730	6,920	1,126	4,504	11,424
Flexible Coupling	2	each	500	1,000	650	1,300	2,300
18-inch BFV w/ Hydraulic Cylinder	5	each	5,000	25,000	2,500	12,500	37,500
Stainless Steel Wire Screen	4	each	3,500	14,000	1,500	6,000	20,000
Hydraulic Accumulator System	1	each	32,000	32,000	41,000	41,000	73,000
Pipe Support	20	each	250	5,000	500	10,000	15,000
Miscellaneous Metalwork	1	LS	3,500	3,500	1,558	1,558	5,058
Electrical/Instrumentation	1	LS	12,000	12,000	5,900	5,900	17,900
Sales Tax on Material Cost, 7.75 percent							10,700
Mobilization & Demobilization, 3 percent							8,092
Subtotal Construction							**288,526**
Contractor OH&P	20 percent						57,705
Total Construction							**346,231**
Contingency	20 percent						69,246
Subtotal Project							**415,477**
Engineering & Administration	15 percent						62,322
Total Project							**477,799**

a) Unit abbreviations: LS = lump sum; CY = cubic yard.
b) Cost for January 2000.



Wide spot in access road, looking east over spillway.

Figure 4-4 Proposed Mahr Reservoir Operations Building Site

For durability and flexibility, the air supply and diffuser pipelines are assumed constructed of 4-inch diameter polyethylene piping. The diffuser pipeline would have small, appropriately-sized holes drilled approximately every five feet for its entire length. This pipeline would be held in place, approximately parallel to the reservoir bottom, by a series of anchors that resist the pipeline's tendency to rise when charged with air. This type system has been operating at SMWD's Upper Oso Reservoir for approximately ten years. While other aeration/destratification systems are feasible, a probable cost opinion for the one described here, with costs adjusted from SMWD's experience, is presented in Chapter 5.

Outflow Chlorination. Open seasonal storage generally degrades bacteriological water quality below those levels specified by Title 22, California Code of Regulations, for disinfected tertiary effluent at a treatment plant production source. The extent of degradation depends on the size of the drainage area tributary to the reservoir and the development characteristics of the drainage area. While not currently required by regulatory agencies, chlorination of reservoir outflow could be done to mitigate this degradation. Because of no regulatory requirement for outflow disinfection, the very small Mahr Reservoir tributary watershed area, and no predominant outflow chlorination practice elsewhere

specifically for disinfection, this candidate improvement is not considered further. It could be reconsidered for a future phase of work.

Outflow Microscreening. Reusing the existing fine screens could provide some control of water quality, although distribution system algae problems still occurred during the original deployment. Such reuse would involve improvements in situ at the Meadowlark WRF or equipment relocation to the Mahr Reservoir site. Some WRF process and related modifications could be required.

A significant drawback to outflow microscreening is the need to break head. Mitigating this hydraulic disruption would require pumping designed for peak-hour flow rate and complex pump controls. In light of these disadvantages, and the years of several major recycled water storage reservoirs (see Chapter 1) operating successfully without such treatment, this candidate improvement is not considered further.

If the need emerges to remove particulate matter in reservoir outflow beyond that removal accomplished by the proposed I/O port screens, large and relatively inexpensive strainers of the type used by SMWD for Upper Oso Reservoir could be deployed. These could be installed in-line, with no head break, on the existing 18-inch I/O line near where it emerges from the downstream dam toe. In normal operation such strainers involve a typical headloss of only a few pounds per square inch.

Reservoir Lining and Covering. Lining and covering a reservoir can control algae growth and other water parameters. Two lining and covering alternatives were considered candidates for Mahr Reservoir:

- Alternative A – a floating cover with a geo-membrane liner
- Alternative B – a floating cover with a porous asphaltic-cement (AC) liner

The geometric configuration of the existing reservoir was reviewed for compatibility with the two commonly used systems for maintaining tension on a floating cover: weight-tensioning and mechanical-tensioning. Weight-tensioned floating covers are distinguished by a series of strategically located trough weights and floats attached to the floating cover to take up excess material and keep the floating cover taut. These trough weights create a fold where excess material accumulates and that also serves as a rainwater collection trough. Rain falling on the floating cover migrates into the troughs and is removed by a rainwater removal system, consisting of pumps or gravity drain assemblies.

With mechanically-tensioned floating covers, cables are attached to the floating cover and connected to a counter-weight and pulley system to maintain floating cover tension. The counterweights are housed in a number of small individual towers surrounding the reservoir perimeter. The rainwater removal system

typically consists of pumps or gravity drains placed on the floating cover to remove surface water.

Both these cover systems have very similar estimated unit costs. The reservoir site can be reconfigured to suit either cover system; however, the mechanically-tensioned cover system would only be practical if the operating water level of the reservoir was restricted to the upper 15 feet of its range. A weight-tensioned cover system would allow the full operating range in the existing reservoir to be used. Therefore, for this evaluation, a weight-tensioned cover system, with 45-mil polypropylene cover material and full perimeter sump, is considered for budget pricing of both lining and covering alternatives.

Recommended impermeable geo-membrane liners for this application include a 45-mil polypropylene liner or a 60- to 90-mil high-density polyethylene (HDPE) liner. HDPE liners are cheaper, but have a higher coefficient of thermal expansion, making installation and maintenance more complicated. For this evaluation, the 45-mil polypropylene liner is considered for budget pricing for Alternative A.

It is anticipated that the addition of an impermeable geo-membrane would require careful review by a geotechnical engineer and DSOD. Key items for consideration by DSOD would be potential loss of soil moisture in the dam embankment, under-drain piping and under-drain relief piping. The loss of moisture in the dam embankment could be significant as the dam core appears to be constructed with clay, based on available record drawings. It is likely the under-drain relief piping could require penetrating the dam embankment to discharge under-drain flows.

Other items that are typically part of an existing reservoir retrofit with a floating cover and a geo-membrane liner include:

- A means to anchor the edge of the liner
- Appurtenances such as vents, access hatches, and inflation ports
- A rainwater relief system

A probable construction cost opinion for adding a floating cover and geo-membrane liner to Mahr Reservoir is shown in Table 4-3. The costs for the basic appurtenances described above are included in the unit cost for the cover and are based on past experience with similar projects.

As described above, it is anticipated that a geo-membrane liner system may not be compatible with the existing dam embankment and would require considerable review by DSOD. Therefore, porous AC liner system, Alternative B, was reviewed as another method for lining the reservoir. This type of liner system would not require an under-drain system and under-drain relief piping. This alternative would likely reduce requirements for DSOD permitting.

Table 4-3 Cost Opinion for Lining and Covering Mahr Reservoir

Item[a]	Quantity[e]	Unit Cost	Total Cost, dollars[f]	
			Alternative A	Alternative B
Porous AC Liner	385,000	$1/SF	N/A	385,000
Polypropylene Liner	385,000	$1/SF	385,000	N/A
Underdrain (in reservoir)	1,600	$25/LF	40,000	N/A
Underdrain (through embankment)	500	$40/LF	20,000	N/A
Base[b]	115,500	$0.75/SF	86,625	86,625
Polypropylene Cover & Appurtenances[c]	350,000	$2.10/SF	735,000	735,000
Concrete Ringwall Appurtenances	2,900	$40/LF	116,000	116,000
Excavation[d]	1	LS	100,000	100,000
Subtotal Construction			**1,482,625**	**1,422,625**
Contractor OH&P	20 percent		296,525	284,525
Total Construction			**1,779,150**	**1,707,150**
Contingency	20 percent		355,830	341,430
Subtotal Project			**2,134,980**	**2,048,580**
Engineering & Administration	15 percent		320,247	307,287
Total Project			**2,455,227**	**2,355,867**

a) This estimate only includes costs for work associated with the liner and cover. Costs for inlet and outlet structures, minor concrete, and other miscellaneous work have not been included.
b) Base quantity assumes a bottom area with 6" thick decomposed granite base. Type and cost of base may change based on a detailed geotechnical evaluation.
c) Appurtenances include vents, access hatches, inflation ports, and rainwater relief system.
d) Excavation cost may change based on actual site conditions and method of excavation.
e) Volume = 160 AF, surface area = 350,000 square feet (SF), bottom area = 385,000 SF, perimeter = 2,900 linear feet.
f) Cost for January 2000.

A probable cost opinion for adding a floating cover with a porous AC liner to Mahr Reservoir is also shown in Table 4-3. The cost for basic appurtenances described above are also included in the unit cost for the cover. These costs are based on past experience with similar projects and accepted cost references.

In order to install either alternative lining and covering system, the existing reservoir would require draining, debris/sludge removal, dewatering and remedial grading to reconfigure the side slopes and reservoir bottom. Prior to liner system installation, base material would be placed as recommended by a geotechnical engineer. For the purposes of this evaluation, allowances have been made for excavation and installation of base material, based on similar projects.

Operation and maintenance costs for a floating cover and liner system depend somewhat on liner alternative. These can be estimated if a decision is made to pursue either lining and cover alternative further.

As shown in Table 4-3, Alternatives A and B have comparable costs; however, Alternative B would not require a possible change to the design intent of the dam embankment nor would it require a piping penetration through the embankment for under-drain relief. For these reasons, it is believed that the Alternative B

would be easier to design, permit and maintain. Based on results of this evaluation, the floating cover with a porous AC liner is considered further in Chapter 5.

Miscellaneous Site Work. Other more minor site improvements may be required in addition to the major ones previously discussed. These items could include improving site access roadways, adding selective landscape treatment, and installing a protective surface on the upstream dam face. The latter could be accomplished with AC pavement, which would mitigate erosion as well as decrease "foothold" for rooted aquatic vegetation. A lump cost opinion is provided for these items in Chapter 5.

Alternative Combinations of Improvements

Two types of facility alternatives are defined: using or not using Mahr Reservoir in the planned recycled water system; and, if the decision is to use Mahr Reservoir, selecting the best combination of facility improvements. To make a fair comparison when Mahr Reservoir is not to be used, equivalent seasonal, operational, and emergency supply components must be considered. These could include additional peak-month supply capacity and an above-ground operational storage reservoir, respectively. These alternatives and cost opinions thereof are discussed in Chapter 5.

The long-term history of other recycled water seasonal storage reservoirs, discussed in Chapter 1, argues strongly against the need for a lining and covering system at Mahr Reservoir. Given that and the relatively large cost of lining and covering systems, two combinations of improvements are considered. The first combination involves the following improvements:

- Dredging and cleaning the reservoir bottom
- Modifying the I/O works
- Adding an aeration/destratification system
- Performing miscellaneous site work.

The second combination involves all the above plus adding lining and covering.

Since Mahr Reservoir has a very small tributary watershed area, the first combination of improvements should provide adequate water quality. Dredging and cleaning, and use of aeration/destratification will tend to maintain an aerobic environment throughout the reservoir water column throughout the year. This will tend to eliminate hydrogen sulfide production and other unpleasant odors. Multiple ports in a modified I/O works will tend to allow best quality water stratum selection. Since algae grow largely near the reservoir water surface, this will tend to greatly minimize the likelihood of algae being moved into the distribution system.

An additional reason, besides cost, exists for deferring further consideration for reservoir lining and covering. In 1997 the State Department of Health Services published a comprehensive evaluation of reservoir lining and covering systems. Their primary focus was a sanitary assessment with respect to potable water storage and quality. However, they noted some generic concerns that would be relevant to application with high-quality recycled water as planned by CMWD:

- Cover materials are "vulnerable to puncture" and "slashes," as from vandalism, and cover seams are "potential weak spots that can compromise the watertight integrity"
- Drainage systems used to remove accumulated rainwater are "not reliable"
- Many of the agencies that have installed lining and covering systems "have attempted to establish... a (maintenance) program but found this process to be exceedingly difficult, labor intensive, and expensive."

Chapter 5 Alternative Costs and Phasing

Mahr Reservoir Use Benefits

Mahr Reservoir can provide seasonal, operational (diurnal), and emergency storage to CMWD's recycled water production and distribution system. Seasonal and emergency storage benefits are quantified in Chapter 3. Absent Mahr Reservoir, CMWD's system would need equivalent peak-month supply capacity. This would require, for comparative analysis, a marginal increase in peak-month supply from the Carlsbad AWT facility, according to the flow rates given in Table 3-3.

From an operational storage perspective, Mahr Reservoir is favorably located geographically and topographically. It provides a storage volume well suited to service demand along Rancho Santa Fe Road, both north and south of the reservoir site, and it could back-feed flow into the lower distribution system pressure zone. The reservoir is also at a key elevation for establishing the hydraulic grade line in the nearby portion of the distribution system. Absent Mahr Reservoir, the system would need equivalent operational storage capacity. This would require, for comparative analysis, an alternative 1.5-MG reservoir at a site in the vicinity near elevation 550 feet.

From an emergency storage perspective, Mahr Reservoir's volume could offset a loss of supply at one of the regular production sources for a given period of time. The appropriate volume would vary depending on total system production capacity available, demand on the distribution system, volume of water in the reservoir, and time of year. For example, if a supply outage occurred in the peak demand month, the volume withdrawn for emergency supply offset would directly eliminate a corresponding volume of peak-month seasonal storage. Emergency storage remains a benefit for Mahr Reservoir, but it is difficult to quantify monetarily. Sample volumetric approximations are given at the end of Chapter 3.

Another possible benefit of Mahr Reservoir relates to ocean outfall capacity. During the winter, Encina WPCF may incur hydraulic limitations in peak wet-weather treated wastewater disposal capacity. Water reclamation, via the

proposed Carlsbad AWT facility, could remove some flow from the disposal stream. Because of low winter demand, such excess recycled water would have to be stored. However, according to the analyses included in Appendix B, even in the current condition, Mahr Reservoir's volume is relatively small and would *not necessarily* take enough flow in the winter to save significant treated wastewater disposal capacity in the ocean outfall system. Appropriate estimations of realistic volumes would require more detailed modeling of Encina WPCF and are beyond this evaluation's scope. Therefore, no benefit is quantified for this function.

Comparative Improvement Costs

For Phase II cost comparison, Alternative 1 includes use of Mahr Reservoir and all the facility improvements summarized at the end of Chapter 4. Alternative 2 replaces Mahr Reservoir with an equivalent new 1.5-MG, above-ground, steel, operational storage reservoir on a newly-purchased site; and 1.46-MGD additional peak-month equivalent supply capacity (see Table 3-3), assumed as a marginal increase to planned Carlsbad AWT expansion capacity. Table 5-1 shows resulting capital costs by line item and totals.

Table 5-1 Comparative Costs for Mahr Reservoir Phase II Capacity Value

Item	Quantity	Unit Cost	Total Cost, dollars[e]	
			Alternative 1[f]	Alternative 2[g]
With Mahr Reservoir				
Dredging & Cleaning[a]	1	lump sum	150,000	N/A
Modified I/O Works[a]	1	lump sum	289,000	N/A
Aeration/Destratification System[a]	1	lump sum	166,000	N/A
Lining and Covering[b]	160 AF	lump sum	1,423,000	N/A
Miscellaneous Site Work[a]	1	lump sum	175,000	N/A
Without Mahr Reservoir				
New Oper. Storage Res. Site[a]	1 acre	lump sum	N/A	100,000
New Oper. Storage Res. Construction[c]	1.5 MG	413,000	N/A	620,000
Additional Peak-Month Plant Capacity[d]	1.46 MGD	1,167,000	N/A	1,704,000
Subtotal Construction			**2,203,000**	**2,424,000**
Contractor OH&P	20 percent		441,000	485,000
Total Construction			**2,644,000**	**2,909,000**
Contingency	20 percent		529,000	582,000
Subtotal Project			**3,173,000**	**3,491,000**
Engineering & Administration	15 percent		476,000	524,000
Total Project			**3,649,000**	**4,015,000**

a) Preliminary estimate.
b) Cost based on lining and covering Alternative B.
c) Volume sized per final distribution system analysis.
d) Capacity based on Chapter 3 analysis, shown in Table 3-3; cost based on incremental capital improvements in *Preliminary Design Report for the Carlsbad Water Recycling Facility.*
e) Cost for January 2000; assumes remainder of recycled water supply and distribution costs for a total Phase II system at 5,400 AFY is the same for both alternatives.
f) Assumes Mahr Reservoir improved for use as operational and seasonal storage.
g) Assumes equivalent operational storage and peak-month supply capacity obtained without Mahr Reservoir.

At this estimating level, Alternative 1's total project cost is slightly less than Alternative 2's total project cost. Alternative 2's total project cost would change a small amount if a different capacity operational storage reservoir were used and if a different plant capacity were chosen. More significantly, Alternative 2's total project cost would increase for the ultimate condition, while Alternative 1's total project cost would not. In that condition, an estimated 3.5 MG of alternative operational storage and a total additional peak-month plant capacity of 1.62 MGD (see Table 3-3) would be needed, which would increase Alternative 2's total project cost by approximately $1,842,000, as shown in Table 5-2. Considering these additional costs to Alternative 2 and the monetarily unquantified emergency storage benefit of Alternative 1, Alternative 1 appears the least-cost capital option.

Table 5-2 Comparative Costs for Mahr Reservoir Ultimate Capacity Value

Item	Quantity	Unit Cost	Total Cost, dollars[d]	
			Alternative 1[e]	Alternative 2[f]
With Mahr Reservoir				
Per Table 5-1	1	lump sum	2,203,000	N/A
Without Mahr Reservoir				
New Oper. Storage Res. Site[a]	2 acres	lump sum	N/A	200,000
New Oper. Storage Res. Construction[b]	3.5 MG	413,000	N/A	1,446,000
Additional Peak-Month Plant Capacity[c]	1.62 MGD	1,167,000	N/A	1,891,000
Subtotal Construction			**2,203,000**	**3,537,000**
Contractor OH&P	20 percent		441,000	707,000
Total Construction			**2,644,000**	**4,244,000**
Contingency	20 percent		529,000	849,000
Subtotal Project			**3,173,000**	**5,093,000**
Engineering & Administration	15 percent		476,000	764,000
Total Project			**3,649,000**	**5,857,000**

a) Preliminary estimate.
b) Volume estimated from ratio of ultimate to Phase II demands.
c) Capacity based on Chapter 3 analysis, shown in Table 3-3; cost based on incremental capital improvements in *Preliminary Design Report for the Carlsbad Water Recycling Facility.*
d) Cost for January 2000; assumes remainder of recycled water supply and distribution costs for a total ultimate system at 9,800 AFY is the same for both alternatives.
e) Assumes Mahr Reservoir improved for use as operational and seasonal storage.
f) Assumes equivalent operational storage and peak-month supply capacity obtained without Mahr Reservoir.

Operating costs for Mahr Reservoir would be relatively minor, and probably comparable to those associated with Alternative 2. They are not considered herein because they would not be expected to affect the decision.

Improvement Phasing

If lining and covering were deleted from Alternative 1, the resulting total cost would be substantially less than the cost for any version of Alternative 2. Alternative 1 could be phased, with initial Mahr Reservoir improvements for Phase II including all items except lining and covering, which would be deferred as discussed in Chapter 4. These Phase II reservoir improvements could be tested for several years before reconsidering the need for additional reservoir improvements. If lining and covering were needed, it could be constructed as part of a Phase III system expansion. Based on Table 5-1, the total project cost opinion for initial reservoir improvements under Alternative 1 is shown in Table 5-3.

Table 5-3 Cost Opinion for Initial Mahr Reservoir Improvements[a]

Item	Quantity	Unit Cost	Total Cost dollars
Dredging & Cleaning	1	lump sum	150,000
Modified I/O Works	1	lump sum	289,000
Aeration/Destratification System	1	lump sum	166,000
Miscellaneous Site Work	1	lump sum	175,000
Subtotal Construction			**780,000**
Contractor OH&P	20 percent		156,000
Total Construction			**936,000**
Contingency	20 percent		187,000
Subtotal Project			**1,123,000**
Engineering & Administration	15 percent		168,000
Total Project			**1,291,000**

a) All entry notes same as for Table 5-1.

Chapter 6 Recommendations

Facilities

In light of the foregoing evaluation and related ongoing preliminary design of CMWD's recycled water distribution system, the following recommendations are made to CMWD regarding Mahr Reservoir:

- Proceed with acquisition of rights from VWD to improve and use the reservoir on a long-term basis
- Phase reservoir improvements as delineated in Chapter 5, with further consideration for a liner and cover deferred to system expansion Phase III
- Design and construct all initial reservoir improvements in parallel with other Phase II system expansion improvements
- Once the improved reservoir is placed in service, test its performance for several years before reconsidering the need for additional improvements.

Monitoring Program

To properly test performance of an improved Mahr Reservoir, an adequate monitoring program will need to be initiated. Such a program typically requires use of a boat for sample acquisition and use of a portable analyzer to measure common limnetic parameters at different depths. Table 6-1 illustrates a typical program, with samples collected in the water column between the existing reservoir I/O works and the upstream dam toe. Daily sample timing would depend on operating times of the proposed aeration/destratification system and any specific regulatory requirements.

Table 6-1 Mahr Reservoir Monitoring Program

Parameter	Method	Depth	Frequency
Dissolved Oxygen	Analyzer	Every 5 feet	Monthly
Temperature	Analyzer	Every 5 feet	Monthly
pH	Analyzer	Every 5 feet	Monthly
Electrical Conductivity	Analyzer	Every 5 feet	Monthly
Oxidation-Reduction Potential	Analyzer	Every 5 feet	Monthly
Turbidity	Analyzer	Every 5 feet	Monthly
Coliform	Grab	Top	Monthly
General Mineral	Grab	Top and Bottom	Quarterly

At the program's onset, similar samples could be collected at a few other locations around the reservoir, to verify that the recommended sample location is adequately representative of the entire water body.

\\NTSERVER\SHARED.FIL\PROJECTS\Powell.207\Carlsbad Ph II.001\Reservoir\Mahrreseval.Doc

At the program's onset, similar samples could be collected at a few other locations around the reservoir, to verify that the recommended sample location is adequately representative of the entire water body.

\\NTSERVER\SHARED.FIL\PROJECTS\Powell.207\Carlsbad Ph II.001\Reservoir\Mahrreseval.Doc

Appendix A

HISTORICAL RECYCLED WATER DEMANDS

CMWD Recycled Water System

Historical Monthly Recycled Water Demands[a] (acre-feet), 1995-1999

Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals	Average	Factors[c] P/A	Factors[c] M/A
1995	Use	18.26	10.65	9.54	42.04	89.83	127.00	149.24	193.48	181.99	128.61	78.10	62.08	1,090.82	90.90		
	Ratio[b]	0.20	0.12	0.10	0.46	0.99	1.40	1.64	**2.13**	2.00	1.41	0.86	0.68			2.13	0.10
1996	Use	33.93	12.11	16.70	89.48	152.55	223.57	198.31	203.14	158.07	130.26	29.78	10.93	1,258.83	104.90		
	Ratio[b]	0.32	0.12	0.16	0.85	1.45	**2.13**	1.89	1.94	1.51	1.24	0.28	0.10			2.13	0.10
1997	Use	11.24	34.59	108.29	132.47	181.82	215.65	179.32	171.35	152.62	110.35	24.06	26.26	1,348.01	112.33		
	Ratio[b]	0.10	0.31	0.96	1.18	1.62	**1.92**	1.60	1.53	1.36	0.98	0.21	0.23			1.92	0.10
1998	Use	14.22	22.29	50.91	90.73	161.27	228.75	191.74	208.43	158.65	103.86	33.23	68.39	1,332.46	111.04		
	Ratio[b]	0.13	0.20	0.46	0.82	1.45	**2.06**	1.73	1.88	1.43	0.94	0.30	0.62			2.06	0.13
1999	Use	15.00	55.38	64.71	143.92	204.23	190.64	332.49	183.97	188.02	146.19	100.79	136.37	1,761.71	146.81		
	Ratio[b]	0.10	0.38	0.44	0.98	1.39	1.30	**2.26**	1.25	1.28	1.00	0.69	0.93			2.26	0.10
Average	Simple	0.17	0.22	0.43	0.86	1.38	1.76	1.82	1.74	1.52	1.11	0.47	0.51	1,358.37	113.20	2.10	0.11
	Adjusted[d]	0.11	0.16	0.37	0.82	1.37	1.83	2.10	1.76	1.51	1.09	0.42	0.46			2.10	0.11

a) Based on actual CMWD metered demands.
b) Annual monthly demand variation expressed as a ratio of actual monthly demand divided by the average monthly demand for that year.
c) Demand factors include peak-to-average (P/A) month and minimum-to-average (M/A) month.
d) See report text for explanation.

Appendix B

SEASONAL STORAGE MODEL RUNS

Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 1A: With Full Seasonal Storage
SUPPLY: RW=1.61 mgd; Other=0 mgd
DEMAND: Current @ 1,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 548 ac-ft required seasonal storage

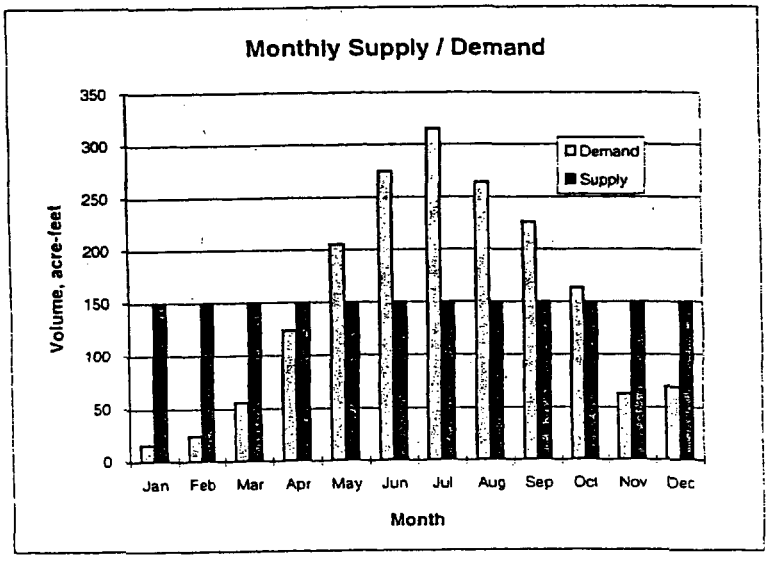
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [o]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	16	0	16	150	0	150	134	302	79
Feb	n/a	n/a	0.16	24	0	24	150	0	150	126	427	79
Mar	n/a	n/a	0.37	56	0	56	150	0	150	94	521	79
Apr	n/a	n/a	0.82	123	0	123	150	0	150	27	548	79
May	n/a	n/a	1.37	205	0	205	150	0	150	(55)	493	79
Jun	n/a	n/a	1.83	275	0	275	150	0	150	(125)	368	79
Jul	**n/a**	**n/a**	**2.10**	**315**	**0**	**315**	**150**	**0**	**150**	**(165)**	**203**	**79**
Aug	n/a	n/a	1.76	264	0	264	150	0	150	(114)	89	79
Sep	n/a	n/a	1.51	226	0	226	150	0	150	(76)	13	79
Oct	n/a	n/a	1.09	163	0	163	150	0	150	(13)	0	79
Nov	n/a	n/a	0.42	63	0	63	150	0	150	87	87	79
Dec	n/a	n/a	0.46	70	0	70	150	0	150	80	168	79
TOTAL	n/a	n/a	12.00	1,800	0	1,800	1,800	0	1,800	0		946

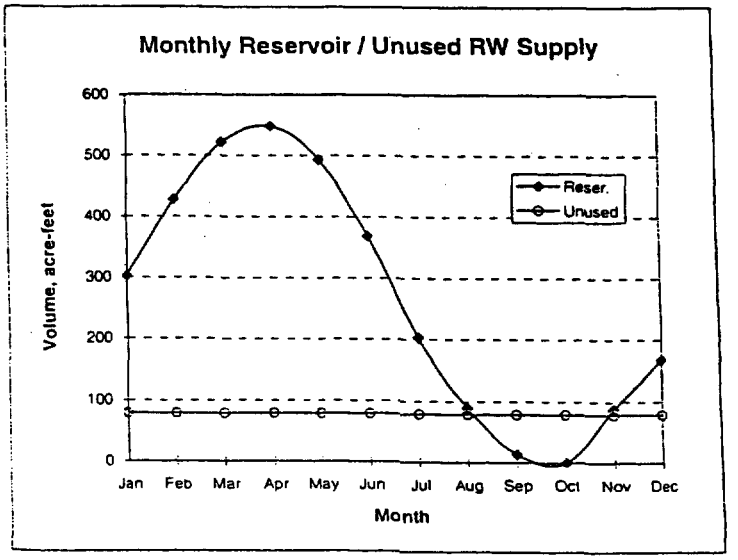
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 1,800 = annual project irrigation demand (ac-ft/yr)
d) 2.45 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 3.00 = maximum reservoir inflow allowed (mgd)
3.00 = maximum reservoir outflow allowed (mgd)
g) 1,000 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 1,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 1.61 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 1.43 = maximum reservoir inflow used (mgd)
10) 1.77 = maximum reservoir outflow used (mgd)
11) 548 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 1B: With No Seasonal Storage
SUPPLY: RW=2.45 mgd; Other=0.92 mgd
DEMAND: Current @ 1,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 0 ac-ft required seasonal storage

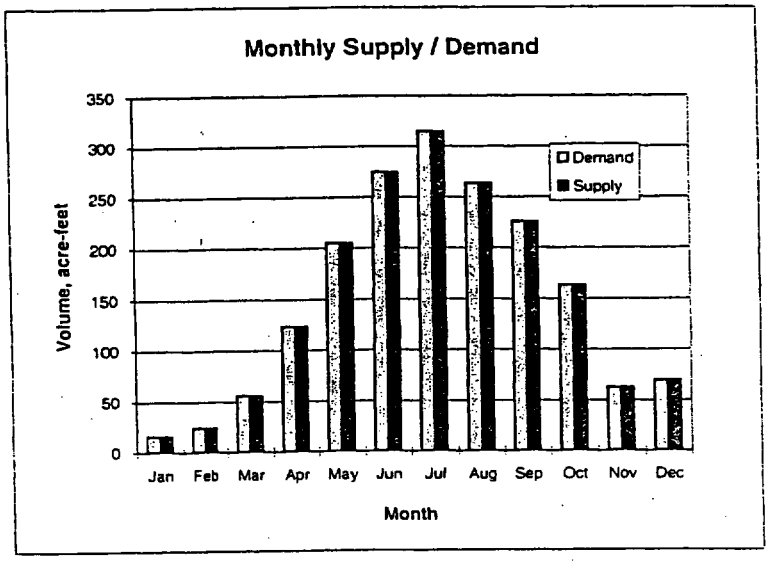
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	16	0	16	16	0	16	0	0	213
Feb	n/a	n/a	0.16	24	0	24	24	0	24	0	0	204
Mar	n/a	n/a	0.37	56	0	56	56	0	56	0	0	173
Apr	n/a	n/a	0.82	123	0	123	123	0	123	0	0	105
May	n/a	n/a	1.37	205	0	205	205	0	205	0	0	24
Jun	n/a	n/a	1.83	275	0	275	229	46	275	0	0	0
Jul	**n/a**	**n/a**	**2.10**	**315**	**0**	**315**	**229**	**86**	**315**	**(0)**	**(0)**	**0**
Aug	n/a	n/a	1.76	264	0	264	229	35	264	0	(0)	0
Sep	n/a	n/a	1.51	226	0	226	226	0	226	0	(0)	3
Oct	n/a	n/a	1.09	163	0	163	163	0	163	0	0	65
Nov	n/a	n/a	0.42	63	0	63	63	0	63	0	0	166
Dec	n/a	n/a	0.46	70	0	70	70	0	70	0	0	159
TOTAL	n/a	n/a	12.00	1,800	0	1,800	1,633	167	1,800	(0)		1,113

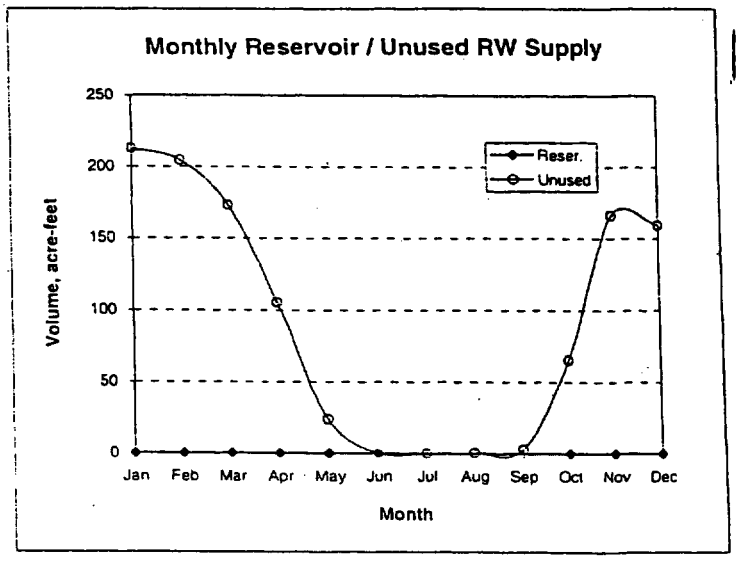
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 1,800 = annual project irrigation demand (ac-ft/yr)
d) 2.45 = maximum recycled water supply available (mgd)
e) 1.00 = maximum other water supply available (mgd)
f) 0.00 = maximum reservoir inflow allowed (mgd)
0.00 = maximum reservoir outflow allowed (mgd)
g) 0 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 1,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 2.45 = maximum RW supply used (mgd)
8) 0.92 = maximum other supply used (mgd)
9) 0.00 = maximum reservoir inflow used (mgd)
10) 0.00 = maximum reservoir outflow used (mgd)
11) 0 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 1C: With Mahr Reservoir Seasonal Storage
SUPPLY: RW=2.45 mgd; Other=0.17 mgd
DEMAND: Current @ 1,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

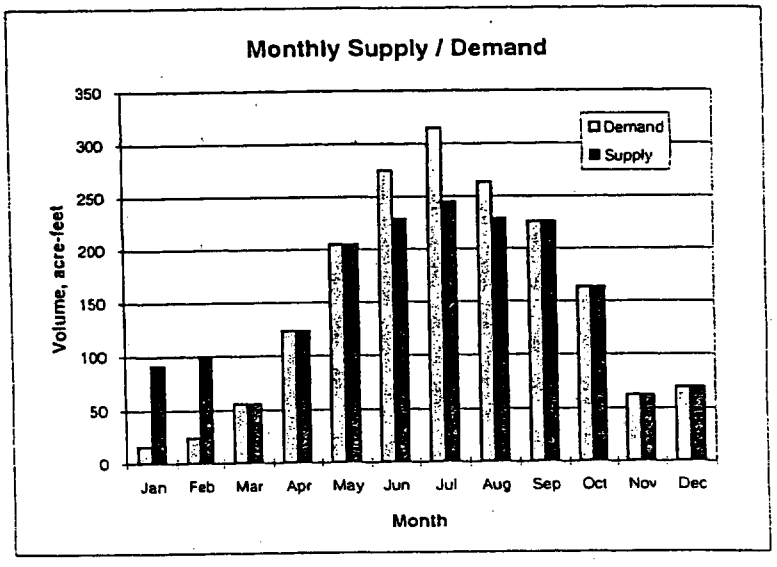
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	16	0	16	92	0	92	76	76	137
Feb	n/a	n/a	0.16	24	0	24	100	0	100	76	151	129
Mar	n/a	n/a	0.37	56	0	56	56	0	56	0	151	173
Apr	n/a	n/a	0.82	123	0	123	123	0	123	0	151	105
May	n/a	n/a	1.37	205	0	205	205	0	205	0	151	24
Jun	n/a	n/a	1.83	275	0	275	229	0	229	(46)	105	0
Jul	**n/a**	**n/a**	**2.10**	**315**	**0**	**315**	**229**	**16**	**245**	**(70)**	**35**	**0**
Aug	n/a	n/a	1.76	264	0	264	229	0	229	(35)	0	0
Sep	n/a	n/a	1.51	226	0	226	226	0	226	0	0	3
Oct	n/a	n/a	1.09	163	0	163	163	0	163	0	0	65
Nov	n/a	n/a	0.42	63	0	63	63	0	63	0	0	166
Dec	n/a	n/a	0.46	70	0	70	70	0	70	0	0	159
TOTAL	n/a	n/a	12.00	1,800	0	1,800	1,784	16	1,800	(0)		962

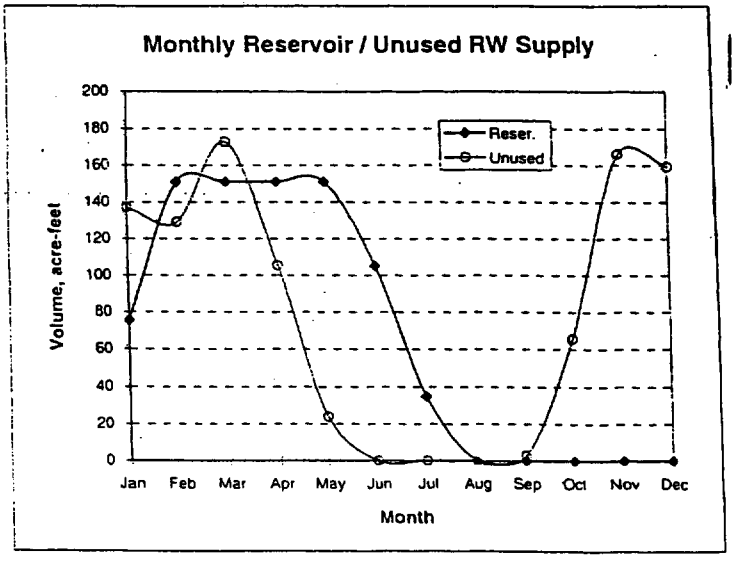
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 1,800 = annual project irrigation demand (ac-ft/yr)
d) 2.45 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 3.00 = maximum reservoir inflow allowed (mgd)
3.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 1,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 2.45 = maximum RW supply used (mgd)
8) 0.17 = maximum other supply used (mgd)
9) 0.81 = maximum reservoir inflow used (mgd)
10) 0.75 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2A: With Full Seasonal Storage
SUPPLY: RW=4.82 mgd; Other=0 mgd
DEMAND: Phase II @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 1,644 ac-ft required seasonal storage

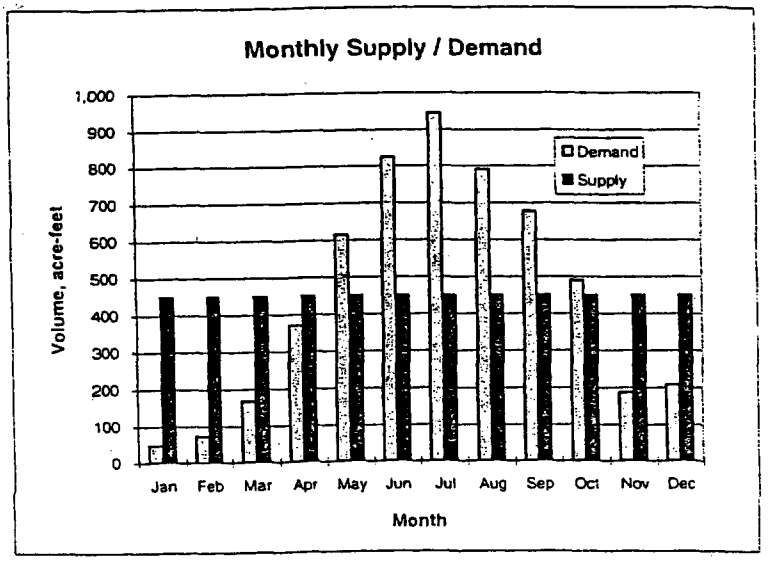
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [a]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [1]	Reser. Storage, ac-ft [9]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	450	0	450	401	905	297
Feb	n/a	n/a	0.16	73	0	73	450	0	450	377	1,282	297
Mar	n/a	n/a	0.37	168	0	168	450	0	450	282	1,564	297
Apr	n/a	n/a	0.82	370	0	370	450	0	450	80	1,644	297
May	n/a	n/a	1.37	615	0	615	450	0	450	(165)	1,479	297
Jun	n/a	n/a	1.83	824	0	824	450	0	450	(374)	1,104	297
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**450**	**0**	**450**	**(495)**	**609**	**297**
Aug	n/a	n/a	1.76	791	0	791	450	0	450	(341)	268	297
Sep	n/a	n/a	1.51	678	0	678	450	0	450	(228)	40	297
Oct	n/a	n/a	1.09	490	0	490	450	0	450	(40)	0	297
Nov	n/a	n/a	0.42	188	0	188	450	0	450	262	262	297
Dec	n/a	n/a	0.46	209	0	209	450	0	450	241	503	297
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,400	0	5,400	(0)		3,565

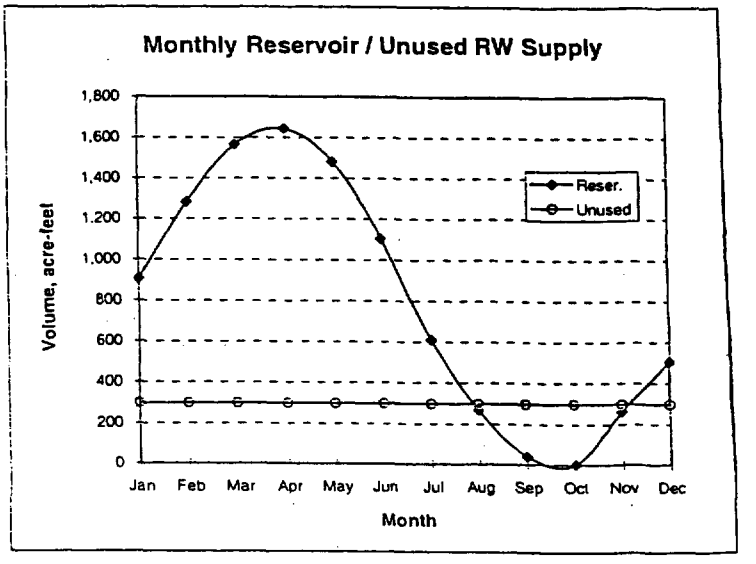
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 2,000 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 4.82 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 4.30 = maximum reservoir inflow used (mgd)
10) 5.30 = maximum reservoir outflow used (mgd)
11) 1,644 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2B: With No Seasonal Storage
SUPPLY: RW=8.00 mgd; Other=2.12 mgd
DEMAND: Phase II @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 0 ac-ft required seasonal storage

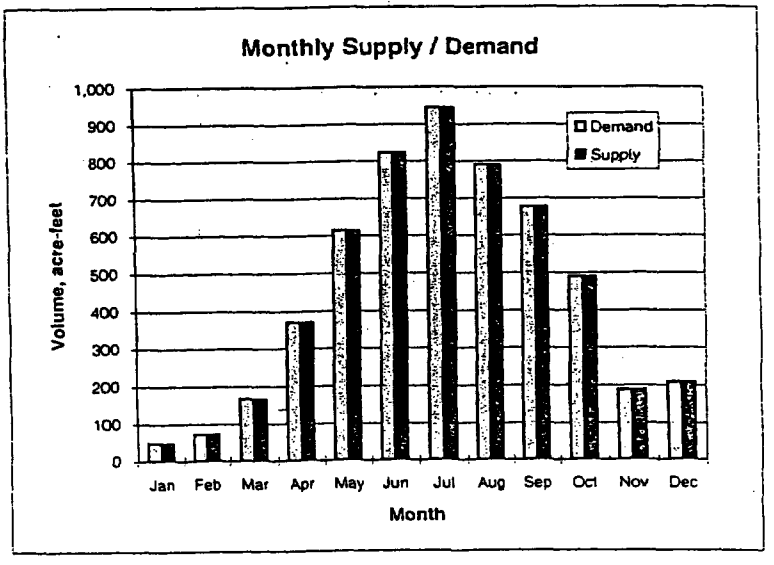
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	49	0	49	0	0	699
Feb	n/a	n/a	0.16	73	0	73	73	0	73	0	0	674
Mar	n/a	n/a	0.37	168	0	168	168	0	168	0	0	579
Apr	n/a	n/a	0.82	370	0	370	370	0	370	0	0	377
May	n/a	n/a	1.37	615	0	615	615	0	615	0	0	132
Jun	n/a	n/a	1.83	824	0	824	747	77	824	(0)	(0)	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**198**	**945**	**(0)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,081	319	5,400	(0)		3,885

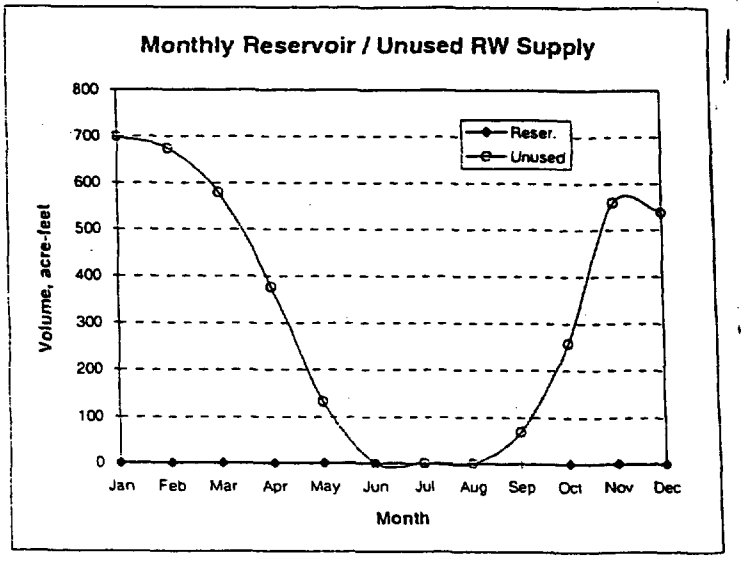
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 0.00 = maximum reservoir inflow allowed (mgd)
0.00 = maximum reservoir outflow allowed (mgd)
g) 0 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 2.12 = maximum other supply used (mgd)
9) 0.00 = maximum reservoir inflow used (mgd)
10) 0.00 = maximum reservoir outflow used (mgd)
11) 0 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2C: With Mahr Reservoir Seasonal Storage
SUPPLY: RW=8.00 mgd; Other=0.66 mgd
DEMAND: Phase II @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

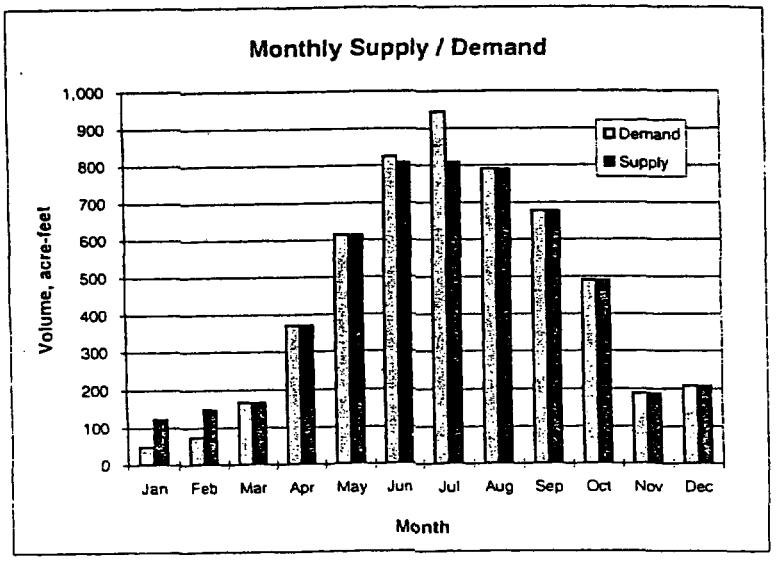
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [b]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [1]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	149	0	149	76	151	598
Mar	n/a	n/a	0.37	168	0	168	168	0	168	0	151	579
Apr	n/a	n/a	0.82	370	0	370	370	0	370	0	151	377
May	n/a	n/a	1.37	615	0	615	615	0	615	0	151	132
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	0	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	0	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	(0)		3,734

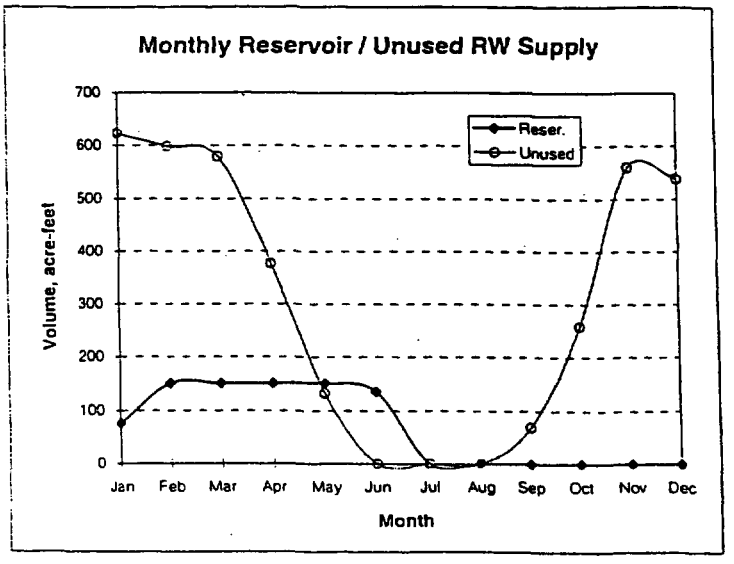
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 0.81 = maximum reservoir inflow used (mgd)
10) 1.46 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 3A: With Full Seasonal Storage
SUPPLY: RW=8.74 mgd; Other=0 mgd
DEMAND: Ultimate @ 9,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 2,983 ac-ft required seasonal storage

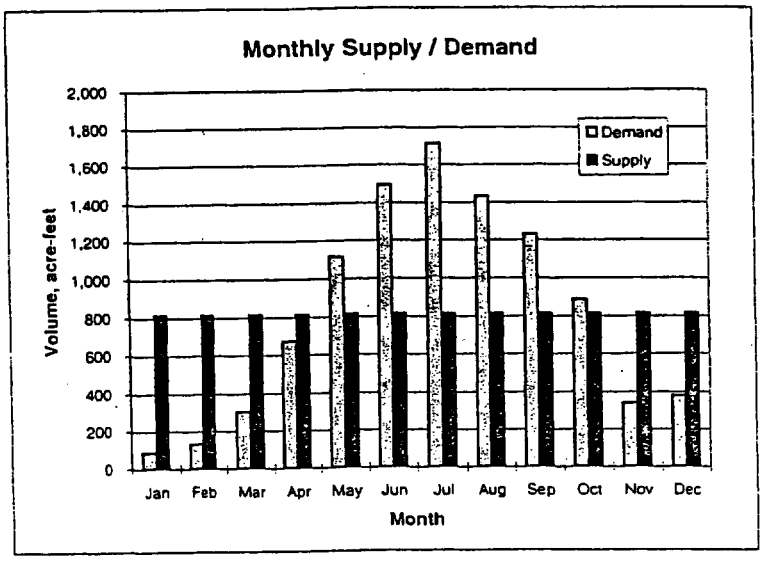
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	88	0	88	817	0	817	729	1,642	1,051
Feb	n/a	n/a	0.16	133	0	133	817	0	817	684	2,326	1,051
Mar	n/a	n/a	0.37	304	0	304	817	0	817	512	2,838	1,051
Apr	n/a	n/a	0.82	672	0	672	817	0	817	145	2,983	1,051
May	n/a	n/a	1.37	1,116	0	1,116	817	0	817	(299)	2,683	1,051
Jun	n/a	n/a	1.83	1,496	0	1,496	817	0	817	(679)	2,004	1,051
Jul	**n/a**	**n/a**	**2.10**	**1,716**	**0**	**1,716**	**817**	**0**	**817**	**(899)**	**1,105**	**1,051**
Aug	n/a	n/a	1.76	1,436	0	1,436	817	0	817	(619)	486	1,051
Sep	n/a	n/a	1.51	1,230	0	1,230	817	0	817	(414)	73	1,051
Oct	n/a	n/a	1.09	889	0	889	817	0	817	(73)	0	1,051
Nov	n/a	n/a	0.42	341	0	341	817	0	817	476	476	1,051
Dec	n/a	n/a	0.46	379	0	379	817	0	817	438	914	1,051
TOTAL	n/a	n/a	12.00	9,800	0	9,800	9,800	0	9,800	0		12,613

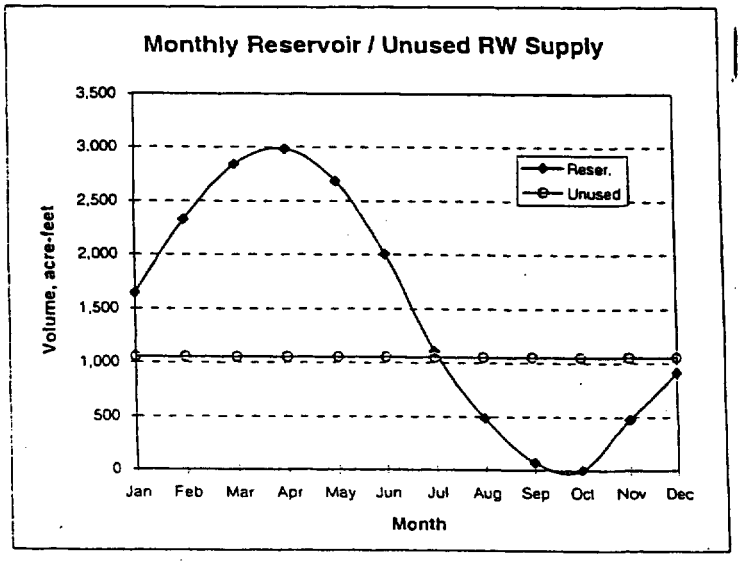
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 9,800 = annual project irrigation demand (ac-ft/yr)
d) 20.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 12.00 = maximum reservoir inflow allowed (mgd)
12.00 = maximum reservoir outflow allowed (mgd)
g) 3,000 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 9,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.74 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 7.80 = maximum reservoir inflow used (mgd)
10) 9.63 = maximum reservoir outflow used (mgd)
11) 2,983 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 3B: With No Seasonal Storage
SUPPLY: RW=18.37 mgd; *Other*=0 mgd
DEMAND: Ultimate @ 9,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 0 ac-ft required seasonal storage

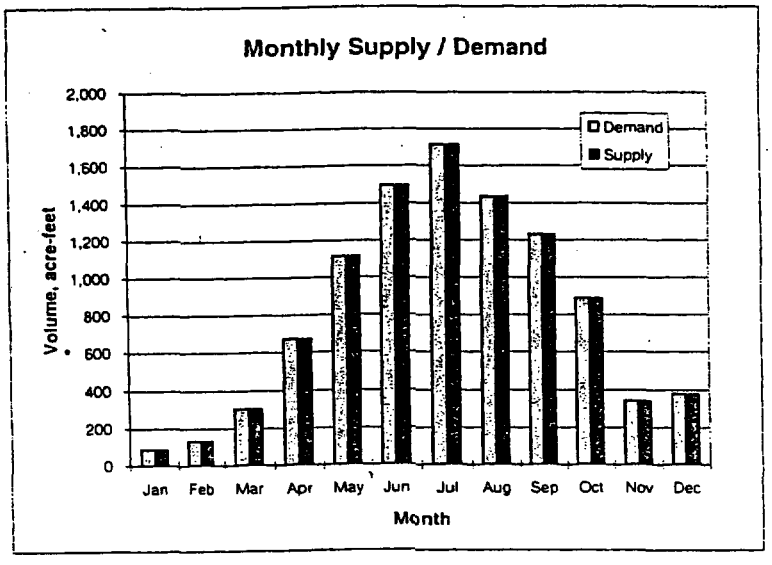
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [a]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	88	0	88	88	0	88	0	0	1,780
Feb	n/a	n/a	0.16	133	0	133	133	0	133	0	0	1,735
Mar	n/a	n/a	0.37	304	0	304	304	0	304	0	0	1,563
Apr	n/a	n/a	0.82	672	0	672	672	0	672	0	0	1,196
May	n/a	n/a	1.37	1,116	0	1,116	1,116	0	1,116	0	0	752
Jun	n/a	n/a	1.83	1,496	0	1,496	1,496	0	1,496	0	0	372
Jul	**n/a**	**n/a**	**2.10**	**1,716**	**0**	**1,716**	**1,716**	**0**	**1,716**	**0**	**0**	**152**
Aug	n/a	n/a	1.76	1,436	0	1,436	1,436	0	1,436	0	0	432
Sep	n/a	n/a	1.51	1,230	0	1,230	1,230	0	1,230	0	0	638
Oct	n/a	n/a	1.09	889	0	889	889	0	889	0	0	979
Nov	n/a	n/a	0.42	341	0	341	341	0	341	0	0	1,527
Dec	n/a	n/a	0.46	379	0	379	379	0	379	0	0	1,489
TOTAL	n/a	n/a	12.00	9,800	0	9,800	9,800	0	9,800	0		12,613

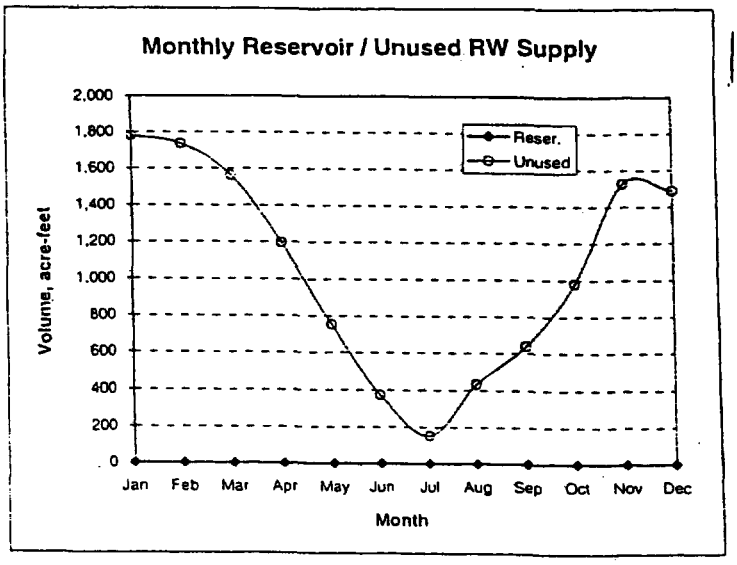
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 9,800 = annual project irrigation demand (ac-ft/yr)
d) 20.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 0.00 = maximum reservoir inflow allowed (mgd)
0.00 = maximum reservoir outflow allowed (mgd)
g) 0 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 9,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 18.37 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 0.00 = maximum reservoir inflow used (mgd)
10) 0.00 = maximum reservoir outflow used (mgd)
11) 0 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 3C: With Mahr Reservoir Seasonal Storage
SUPPLY: RW=16.76 mgd; Other=0 mgd
DEMAND: Ultimate @ 9,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

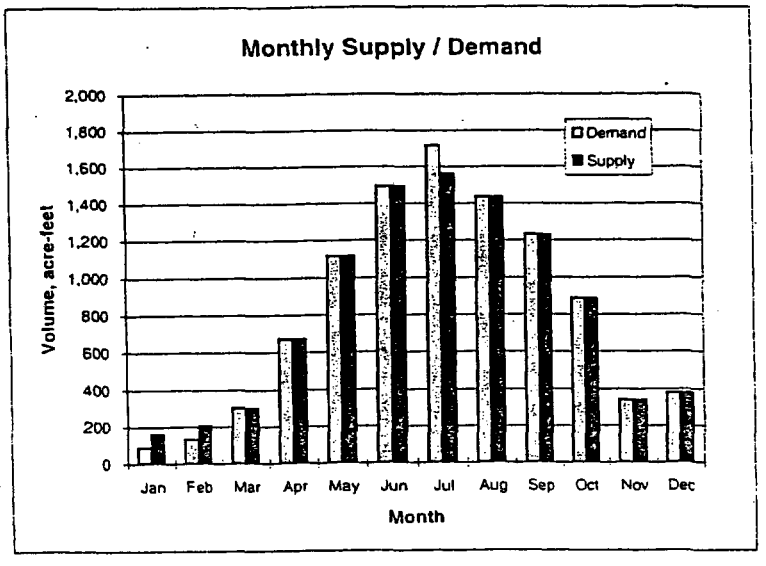
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	88	0	88	164	0	164	76	76	1,704
Feb	n/a	n/a	0.16	133	0	133	208	0	208	76	151	1,659
Mar	n/a	n/a	0.37	304	0	304	304	0	304	0	151	1,563
Apr	n/a	n/a	0.82	672	0	672	672	0	672	0	151	1,196
May	n/a	n/a	1.37	1,116	0	1,116	1,116	0	1,116	0	151	752
Jun	n/a	n/a	1.83	1,496	0	1,496	1,496	0	1,496	0	151	372
Jul	**n/a**	**n/a**	**2.10**	**1,716**	**0**	**1,716**	**1,565**	**0**	**1,565**	**(151)**	**0**	**303**
Aug	n/a	n/a	1.76	1,436	0	1,436	1,436	0	1,436	0	0	432
Sep	n/a	n/a	1.51	1,230	0	1,230	1,230	0	1,230	0	0	638
Oct	n/a	n/a	1.09	889	0	889	889	0	889	0	0	979
Nov	n/a	n/a	0.42	341	0	341	341	0	341	0	0	1,527
Dec	n/a	n/a	0.46	379	0	379	379	0	379	0	0	1,489
TOTAL	n/a	n/a	12.00	9,800	0	9,800	9,800	0	9,800	0		12,613

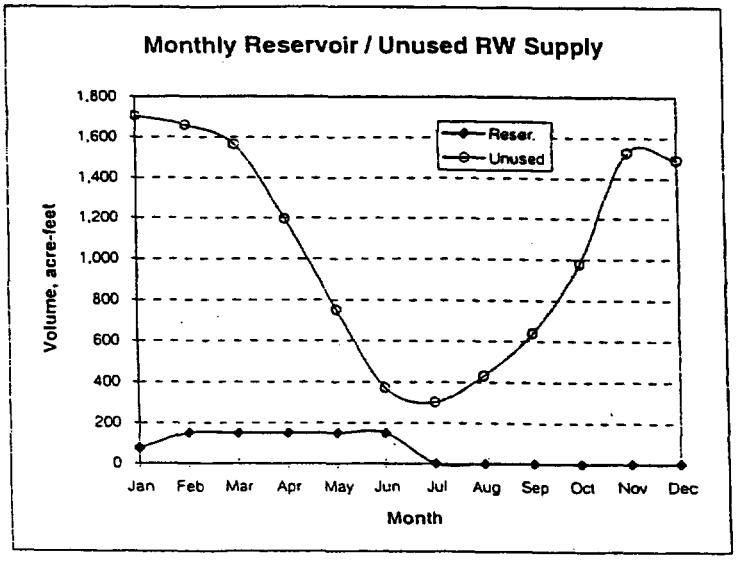
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 9,800 = annual project irrigation demand (ac-ft/yr)
d) 20.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 3.00 = *maximum reservoir inflow allowed (mgd)*
3.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 9,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = *minimum irrigation demand month*
7) 16.76 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 0.81 = maximum reservoir inflow used (mgd)
10) 1.61 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Appendix C

EMERGENCY STORAGE MODEL RUNS

Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2D: With Mahr Reservoir Seasonal and Emergency Storage
SUPPLY: RW=8.00 mgd with loss of 149 ac-ft in February; Other=0.66 mgd
DEMAND: Current @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

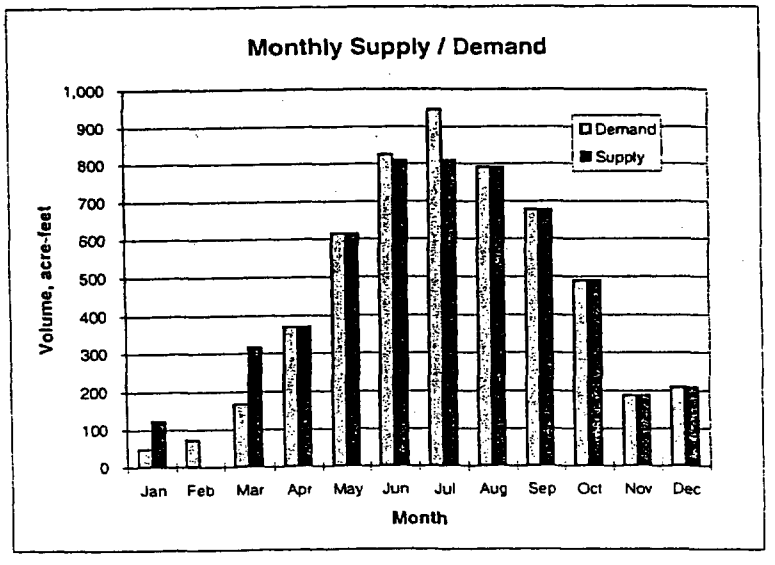
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [o]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	0	0	0	(73)	2	747
Mar	n/a	n/a	0.37	168	0	168	317	0	317	149	151	430
Apr	n/a	n/a	0.82	370	0	370	370	0	370	0	151	377
May	n/a	n/a	1.37	615	0	615	615	0	615	0	151	132
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	0		3,733

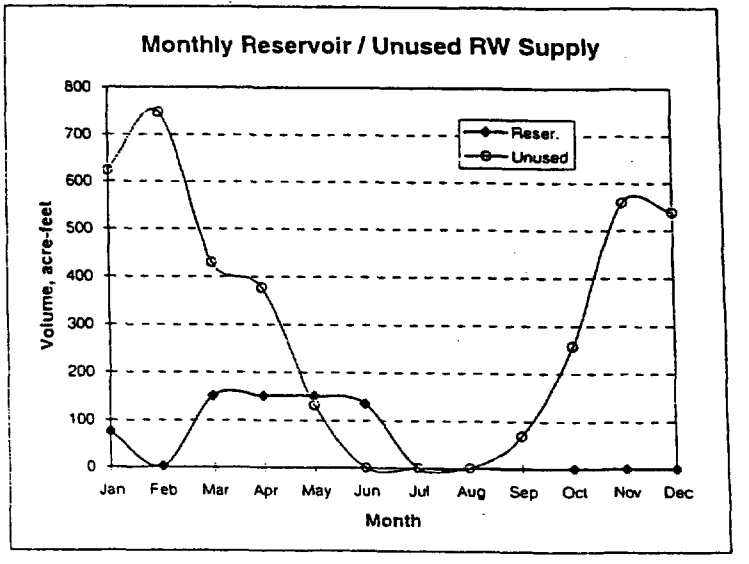
INPUT

a) n/a = *effective/total precipitation ratio* (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 1.60 = maximum reservoir inflow used (mgd)
10) 1.46 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2D: With Mahr Reservoir Seasonal and Emergency Storage
SUPPLY: RW=8.00 mgd with loss of 151 ac-ft in March; Other=0.66 mgd
DEMAND: Current @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

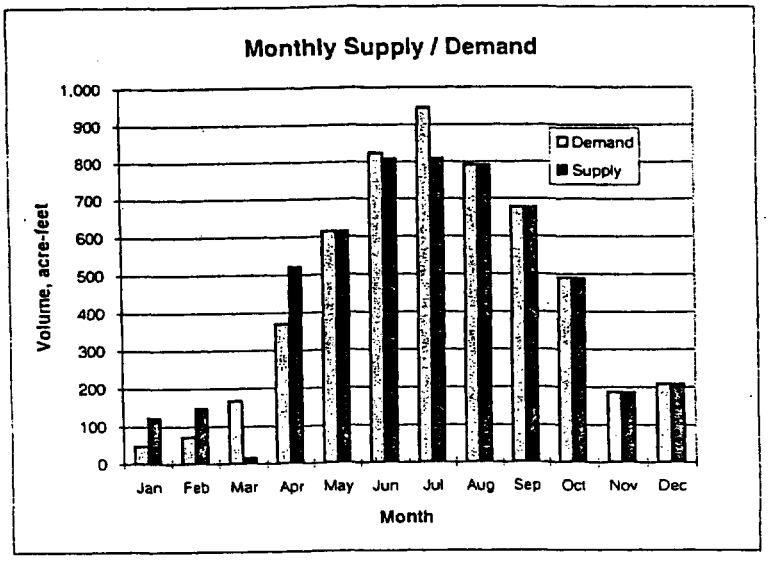
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	149	0	149	76	151	598
Mar	n/a	n/a	0.37	168	0	168	17	0	17	(151)	0	730
Apr	n/a	n/a	0.82	370	0	370	521	0	521	151	151	226
May	n/a	n/a	1.37	615	0	615	615	0	615	0	151	132
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	(0)		3,734

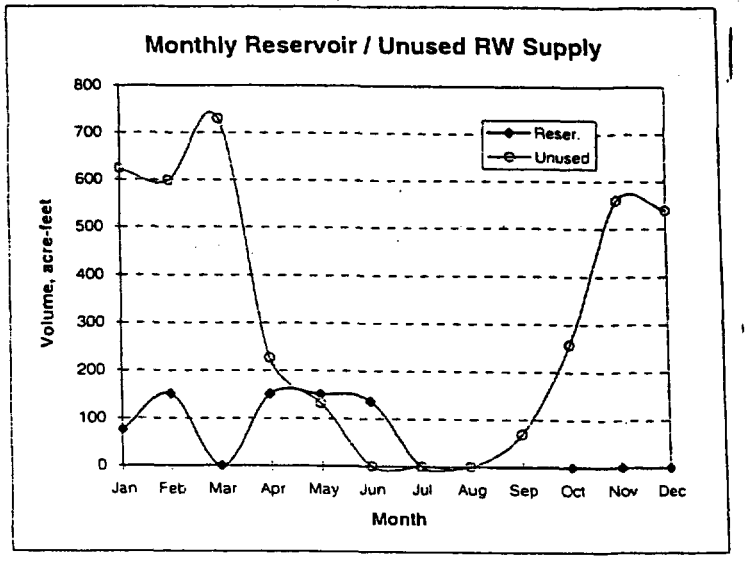
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 1.61 = maximum reservoir inflow used (mgd)
10) 1.61 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





AGREEMENT FOR SALE OF RECYCLED WATER
TO THE CITY OF CARLSBAD BY THE
LEUCADIA COUNTY WATER DISTRICT

This RECYCLED WATER SALES AGREEMENT (AGREEMENT) is made and entered into this 25th day of March, 1991, by and between the Leucadia County Water District, a County Water District existing under the California Water Code, hereinafter referred to as "LEUCADIA," and the CARLSBAD MUNICIPAL WATER DISTRICT, a municipal water district, hereinafter referred to as the "WATER DISTRICT."

RECITALS:

WHEREAS, the WATER DISTRICT is responsible for the distribution of potable water within its DISTRICT boundary; and,

WHEREAS, the WATER DISTRICT and LEUCADIA recognize the use of recycledwater (treated domestic wastewater) as a positive and achievable means of helping to meet the growing water demands of Southern California in the future; and,

WHEREAS, LEUCADIA operates the Forest R. Gafner Water Reclamation Plant for the treatment of domestic wastewater and which is capable of producing up to 0.75 million gallons per day (MGD); and,

WHEREAS, the WATER DISTRICT is interested in purchasing recycled water from LEUCADIA for purveyance to ultimate users for golf course irrigation and other appropriate uses within the WATER DISTRICT'S boundary; and,

WHEREAS, the California Regional Water Quality Control Board, San Diego Region (hereinafter known as REGIONAL BOARD) adopted on January 23, 1984, ORDER No. 84-10, WATER RECLAMATION REQUIREMENTS FOR THE CITY OF CARLSBAD FOR THE PURVEYANCE OF RECLAIMED WATER IN SAN DIEGO COUNTY, which permits the CITY and the WATER DISTRICT to distribute within its boundaries recycled water; and,

WHEREAS, on May 4, 1987, the REGIONAL BOARD adopted ORDER NO. 87-82, WASTE DISCHARGE REQUIREMENTS FOR LEUCADIA COUNTY WATER DISTRICT FOREST R. GAFNER WATER RECLAMATION PLANT NEAR THE CITY OF CARLSBAD, SAN DIEGO COUNTY, as an update to its previous ORDER NO. 79-35 of the same name. Order No. 87-82, in its findings, states that up to 0.75 MGD of secondary recycled water from LEUCADIA'S Forest R. Gafner Water Reclamation Plant will be used for the irrigation of the 250-acre La Costa Golf Course within the WATER DISTRICT. The Order further states that recycled water from the plant would be chlorinated and pumped to a small lake in the La Costa Golf Course and the lake would hold the recycled water until

being repumped for irrigation. Order No. 87-82 further states that the golf course reservoir shall be at all times protected against erosion, flooding, overland runoff resulting from a 2-year frequency 24-hour storm; and that discharge of recycled water to the golf course reservoir is prohibited from November 1 through March 30. A copy of Order No. 87-82 is attached hereto and incorporated herein by this reference as Exhibit "A"; and,

WHEREAS, in a letter dated August 18, 1978, the California Department of Health Services required LEUCADIA to upgrade its treatment plant to meet the most stringent provisions of Article 5, Title 22, Division 4, of the California Administrative Code (hereinafter referred to as Title 22 Requirements) prior to use of its recycled water for the irrigation of the La Costa Golf Course. A copy of said letter is attached hereto and incorporated herein by this reference as Exhibit "B"; and,

WHEREAS, LEUCADIA is at present in the process of upgrading its Forest R. Gafner Water Reclamation Plant to meet the most stringent Title 22 Requirements, and is scheduled to complete this facilities upgrade by October 1993 .

WHEREAS, in order for the DISTRICT to qualify for and receive state funding to upgrade the Gafner plant as referenced above, it is a requirement of the state that a commitment be made for the purchase of a minimum amount of recycled water; and,

WHEREAS, it is the mutual desire of the parties hereto to establish herein an agreement for the delivery of a minimum commitment of 394 acre feet and of up to 840 acre-feet on an average annual basis of recycled water from the Forest R. Gafner Water Reclamation Plant to the WATER DISTRICT for the purposes and on the terms and conditions herein set forth, and in such a manner as to qualify LEUCADIA for the necessary state loan; and,

NOW, THEREFORE, in consideration of these recitals and the mutual covenants contained herein, WATER DISTRICT and LEUCADIA agree as follows:

SECTION 1. DELIVERY AND ACCEPTANCE

LEUCADIA agrees to deliver to WATER DISTRICT and WATER DISTRICT agrees to accept from LEUCADIA recycled water produced at the Forest R. Gafner Water Reclamation Plant in the quantities and on the terms and conditions specified in this AGREEMENT.

SECTION 2. TREATMENT STANDARDS

LEUCADIA shall treat the wastewater to be delivered to the WATER DISTRICT in conformance with the standards of the REGIONAL BOARD as specified in Exhibit "A" and as specified by the Health Department in Exhibit "B." If applicable regulatory requirements

are made more stringent by the San Diego Regional Water Quality Board, the California Water Resources Board, or the State Health Department such that upgraded treatment is required, LEUCADIA shall have the option to terminate its obligations under this AGREEMENT on sixty (60) days written notice to WATER DISTRICT; or to upgrade the plant to meet the new requirements subject to negotiation of the cost thereof with WATER DISTRICT. In the event that LEUCADIA chooses to upgrade the plant to meet the new requirements WATER DISTRICT shall continue to purchase recycled water as herein provided following the upgrade.

SECTION 3. QUANTITY TO BE DELIVERED

LEUCADIA shall operate the Forest R. Gafner Water Reclamation Plant so as to produce up to 0.75 million gallons per day (MGD), of recycled water for delivery to WATER DISTRICT under this AGREEMENT, consistent with sound management practices, applicable government regulations and requirements, and commitments to other customers, if any. The parties hereto understand that the volume of recycled water that will be delivered to WATER DISTRICT will be about 394 acre-feet per year, but that the actual volume per year will vary according to seasonal needs for irrigation water. The parties further understand and accept the fact with no liability to LEUCADIA that there may be day to day interruptions in service due to plant emergencies requiring occasional plant shut-down and repair associated with acts of God, orders by regulatory bodies and judicial courts, and/or equipment breakdowns.

The General Managers or their Designee of the WATER DISTRICT and LEUCADIA shall meet monthly to establish a schedule for delivery of recycled water. LEUCADIA and WATER DISTRICT shall make every reasonable effort to comply with such delivery schedules once mutually accepted.

WATER DISTRICT agrees to accept a minimum of 394 acre feet of recycled water per year. If WATER DISTRICT accepts and pays for more than 394 acre feet of recycled water in any given year, WATER DISTRICT shall be entitled to a carry forward credit for every acre foot (or portion thereof) so purchased over the 394 acre foot minimum. Such carry forward may be applied in future years to meet the 394 acre foot minimum purchase requirement. It is recognized that LEUCADIA must have a commitment to a minimum purchase in order to meet the requirements of its state loan to upgrade the Gafner plant.

In the event that WATER DISTRICT decides to purchase additional recycled water from LEUCADIA, WATER DISTRICT shall inform LEUCADIA of its desire to increase the quantity of recycled water purchased. WATER DISTRICT shall have those rights of first refusal to purchase additional water set forth in Section 11.

SECTION 4. MWD OR OTHER REBATE

Any rebate or other incentive payment from the Metropolitan Water District (MWD) or from any other governmental agency now available or available at any time in the future for this recycled water project shall be secured by and be the responsibility of LEUCADIA.

SECTION 5. METERS

LEUCADIA shall be responsible for installing and maintaining a flow meter at the Forest R. Gafner Plant that will measure the quantity of recycled water supplied to the WATER DISTRICT pursuant to this AGREEMENT. LEUCADIA shall be responsible for operating, maintaining, calibrating, and reading this flow meter on a regular basis. LEUCADIA shall read and report to WATER DISTRICT meter results no less than once per month. Results of calibrations shall be copied to the WATER DISTRICT on a regular basis.

SECTION 6. OWNERSHIP, OPERATION, AND MAINTENANCE.

LEUCADIA shall have no responsibility for owning, operating, or maintaining the recycled water storage and distribution system, except for downstream of the point of delivery as shown on Exhibit "C." All facilities and equipment beyond the point of delivery shall be the responsibility of WATER DISTRICT and the ultimate user, as they shall agree amongst themselves. Both parties to this AGREEMENT shall grant each other necessary easements and rights of way to operate and maintain the reclamation facilities described herein on lands they control, and each shall assist the other to obtain easements or rights of way on lands controlled by other entities not subject to this AGREEMENT. WATER DISTRICT will arrange for necessary easements in favor of LEUCADIA for the construction, installation, and maintenance of facilities required to deliver recycled water to the point of delivery as shown on Exhibit "C," to the extent that such easements do not already exist.

SECTION 7. RECYCLED WATER QUALITY

LEUCADIA shall use its best good faith efforts to ensure that the recycled water delivered to WATER DISTRICT shall have a quality meeting the standards and approvals herein specified. LEUCADIA represents and warrants that it will meet the following requirements:

a. LEUCADIA will do all testing as required by the terms of its permits, on the schedule specified in the permits;

b. All recycled water delivered pursuant to this AGREEMENT will meet the standards stated in Exhibit "A";

c. LEUCADIA will not substantially change any of its treatment practices in a manner which will cause a decrease in water quality of the recycled water without notifying WATER DISTRICT in advance.

Both parties to this AGREEMENT understand that the presence of dissolved minerals in the recycled water and other substances in higher concentrations can be deleterious to the plants irrigated with such water. LEUCADIA agrees to do everything reasonably within its power to ensure that the quality of the recycled water it delivers pursuant to this AGREEMENT will not be harmful to the golf course areas to be irrigated. These efforts shall include a ban by LEUCADIA of self-regenerization water softening equipment within LEUCADIA'S boundaries as outlined in Ordinance 10, attached hereto as Exhibit "D." LEUCADIA shall further mail annual notices to residents and vendors of water softening equipment notifying them of the prohibition against self-regenerization water softening equipment.

Both parties further agree that failure to supply recycled water with a TDS concentration less than 1,000 milligrams per liter (mg/1) as determined in conformance with the methodology specified in the project's waste discharge permit may be sufficient grounds for CITY to suspend its obligation to accept and pay for recycled water until the recycled water quality is restored to less than 1,000 (mg/1) TDS.

The parties recognize during periods of drought LEUCADIA may experience lower flows as a result of conservation efforts. However, the amount of solids received would not decrease and could cause the TDS levels to rise. During such drought periods as designated by the WATER DISTRICT the parties agree recycled water with a TDS concentration of no more than 1,200 mg/1 will be an acceptable quality under the terms of this agreement.

SECTION 8. USE OF RECYCLED WATER

The WATER DISTRICT agrees that the use of recycled water delivered pursuant to this AGREEMENT shall be confined to the boundaries of Carlsbad.

SECTION 9. RECYCLED WATER DELIVERY PRESSURE

Recycled water delivered by LEUCADIA to WATER DISTRICT shall be at no guaranteed minimum pressure, provided LEUCADIA will pump to the La Costa Lake.

SECTION 10. COMPLIANCE WITH REGULATORY REQUIREMENTS

WATER DISTRICT agrees to comply with all applicable recycled water distribution regulations issued and/or mandated by the California Department of Health Services, the County of San Diego

Department of Health, and the REGIONAL BOARD. WATER DISTRICT shall be responsible for insuring that all users of recycled water within WATER DISTRICT's jurisdiction shall first apply for and receive California Water Reclamation Requirements issued by the REGIONAL BOARD, and that all users shall be made to comply with WATER DISTRICT'S most up-to-date recycled water RULES AND REGULATIONS. LEUCADIA shall bear no responsibility or liability for compliance with such rules and regulations by WATER DISTRICT, the ultimate user, or anyone else beyond the point of delivery as shown on Exhibit "C."

SECTION 11. PRICE OF RECYCLED WATER

WATER DISTRICT shall pay LEUCADIA for all recycled water delivered by LEUCADIA pursuant to this AGREEMENT with the minimum purchase in any given year being 394 acre feet, adjusted to take into account the WATER DISTRICT'S right to carry forward credits as provided for in paragraph three above. The basic price payable by WATER DISTRICT to LEUCADIA shall be ninety-nine percent (99%) of the retail potable water price charged to residential users within the WATER DISTRICT boundary.

WATER DISTRICT shall have a right of first refusal to purchase additional recycled water from LEUCADIA on the following terms:

a. The price and payment terms shall be as set forth in this Agreement;

b. WATER DISTRICT'S right of first refusal shall be subject to any official policy or policies established by LEUCADIA, by ordinance or resolution, in effect at the time governing priority of access to recycled water;

c. WATER DISTRICT shall give LEUCADIA at least 30 days advance notice of its intent to exercise, in whole or in part, its rights of first refusal; and

d. WATER DISTRICT'S rights are subject to LEUCADIA'S recycled water availability.

SECTION 12. TERMS OF PAYMENT

WATER DISTRICT shall be invoiced by LEUCADIA for recycled water delivered to WATER DISTRICT at least quarterly, but no more frequently than monthly, and WATER DISTRICT agrees to pay LEUCADIA for such deliveries within 30 days of receipt of an invoice from LEUCADIA for such purchases.. In the event payment is more than 30 days in arrears, LEUCADIA reserves the right to stop delivery of recycled water until payment is made, or to charge a penalty of one percent (1%) per month on delinquent amounts, or to specifically enforce WATER DISTRICT'S payment obligations pursuant to Section 19 hereof.

SECTION 13. ACCESS TO RECORDS

LEUCADIA and WATER DISTRICT shall keep proper books and records, in which complete and correct entries shall be made of all recycled water delivered throughout the duration of this AGREEMENT. Said books and records shall, upon written request, be subject to inspection by any duly authorized representative of LEUCADIA, WATER DISTRICT, and the REGIONAL BOARD or any agency providing a rebate to LEUCADIA.

SECTION 14. NOTICE

Notices required or permitted under this AGREEMENT shall be sufficiently given if in writing and if either served personally upon the party to whom it is directed or by deposit in the United States mail, postage prepaid, certified, return receipt requested, addressed to the parties at the following addresses:

a. WATER DISTRICT
General Manager
Carlsbad Municipal Water District
5950 El Camino Real
Carlsbad, CA 92008

b. LEUCADIA
General Manager
Leucadia County Water District
1960 La Costa Avenue
Carlsbad, CA 92009

It shall be the sole responsibility of each party to this AGREEMENT to promptly notify the other of any change of title and/or address as long as this AGREEMENT remains in effect.

SECTION 15. ASSIGNMENT

The rights and obligations of the parties under this AGREEMENT shall not be assigned, or transferred without the prior written consent of the other party, which consent shall not be unreasonably withheld.

SECTION 16. EFFECTIVE DATE

This AGREEMENT shall become effective upon the date at which it is executed by both parties hereto.

SECTION 17. TERMINATION OF AGREEMENT

The term of this AGREEMENT shall be twenty (20) years, subject to the rights of the parties to an earlier termination as provided in SECTION 18 hereof. This AGREEMENT shall continue in force from year to year after the initial twenty-year term of the AGREEMENT

until either party gives one year written notice to the other of its intention to terminate or renegotiate the AGREEMENT. The AGREEMENT shall terminate one year from the date upon which such written notice is received unless the parties agree otherwise, in writing.

SECTION 18. EARLY TERMINATION

a. LEUCADIA Termination. If at any time during the term of this AGREEMENT recycled water in compliance with the quality standards of Section Seven of this AGREEMENT cannot lawfully be used by WATER DISTRICT for the purposes intended by this AGREEMENT, because of government regulations now in effect or hereinafter imposed, LEUCADIA may terminate this AGREEMENT with no further obligation by giving sixty (60) days written notice thereof to WATER DISTRICT,or at LEUCADIA'S option, specifically enforce WATER DISTRICT'S obligations pursuant to Section 19 hereof.

b. WATER DISTRICT Termination. WATER DISTRICT shall be entitled to terminate this AGREEMENT early for an act of God or if LEUCADIA fails to deliver recycled water to WATER DISTRICT meeting the quality standards of Section Seven hereof. Provided, however, that WATER DISTRICT must first give LEUCADIA written notice of any alleged deficiency in the recycled water quality and a minimum sixty (60) day period to cure the problem, or longer if a longer cure period is reasonably required. If WATER DISTRICT gives such notice and LEUCADIA fails to cure the problem within the 60 day cure period, or if a longer period is reasonably necessary and LEUCADIA is not diligently pursuing a cure, WATER DISTRICT may upon thirty (30) days further written notice terminate this AGREEMENT with no further obligation on its part. So long as the recycled water meets the quality standards provided for herein, or in the event of a change in standards or a decline in quality, so long as LEUCADIA is diligently endeavoring to meet the new standards or cure the quality problem, and provided that LEUCADIA does in fact cure the problem as provided above, WATER DISTRICT shall not have a right to terminate this AGREEMENT. However, the WATER DISTRICT reserves the right to refuse delivery of recycled water and payment thereof, until the quality again meets all previously stated standards.

SECTION 19. SPECIFIC PERFORMANCE.

In recognition of the fact that LEUCADIA has made a long term capital commitment to this project and has undertaken a long term loan committment with the State related thereto, and in recognition of the fact that WATER DISTRICT is making a long term commitment to the project, the parties agree that specific performance shall be available to enforce the obligations of the parties hereunder, including LEUCADIA'S obligation to deliver recycled water as required hereunder and WATER DISTRICT'S obligation to accept and pay for the same. The parties agree that specific performance

shall be available as a remedy in addition to any other available remedy. The parties expressly agree that money damages for a breach is an inadequate remedy.

SECTION 20. ENTIRE AGREEMENT.

This AGREEMENT constitutes the entire understanding between the parties hereto with respect to the subject matter hereof superseding all negotiations, prior discussions and preliminary agreements and understandings, written or oral. This AGREEMENT shall not be amended, except by written consent of the parties hereto, and no waiver of any rights under this AGREEMENT shall be binding unless it is in writing signed by the party waiving such rights. In the event any provision of this AGREEMENT shall be held to be invalid and unenforceable, the other provisions of this AGREEMENT shall be held to be valid and binding on the parties hereto.

SECTION 21. BINDING EFFECT.

This AGREEMENT shall be binding upon the parties hereto and their respective successors in interest, permitted assigns, executors, administrators, and personal representatives.

SECTION 22. LIABILITY AND INDEMNIFICATION.

LEUCADIA assumes all liability for damage to persons or property caused by the recycled water prior to the time that it reaches the point of delivery as designated on Exhibit "C" hereto. LEUCADIA agrees to indemnify, defend, and hold harmless WATER DISTRICT, its officers, agents, and employees from any and all claims, demands, actions, liability or loss which may arise from LEUCADIA'S storage, use, treatment or delivery of the treated effluent prior to the time it passes the point of delivery. In addition, LEUCADIA agrees to assume all liability for damage to persons or property caused in any manner by the delivery of water which does not meet the quality standards of Section Seven hereof.

WATER DISTRICT assumes all liability except as defined in the preceding paragraph for damage to persons or property caused in any manner by the recycled water once it passes the point of delivery as shown on Exhibit "C" hereto. WATER DISTRICT agrees to indemnify, defend, and hold harmless LEUCADIA, its officers, agents, and employees from any and all claims, demands, actions, liability or loss which may arise from WATER DISTRICT'S storage, use, or delivery of recycled water after it passes the point of delivery.

WATER DISTRICT understands that the product being sold by LEUCADIA is treated waste water effluent and that its purity and chemical composition cannot be guaranteed by LEUCADIA beyond LEUCADIA'S obligation to meet the quality standards of Section

Seven hereof. WATER DISTRICT acknowledges that no warranty or other representation as to the physical, chemical, or biological quality of the recycled water is made by LEUCADIA, except for LEUCADIA'S obligation to meet the quality standards of Section Seven hereof.

SECTION 23. ATTORNEY'S FEES

If any Court action is brought to enforce or interpret the provisions of this AGREEMENT, the prevailing party shall be entitled to reasonable attorney's fees and expert witness fees, which may be set by the Court or arbitrator in the same action brought for that purpose, in addition to any other relief to which may be granted.

SECTION 24. VENUE

In the event of any disagreement as to the interpretation, effect, enforceability, or the rights of the parties under this AGREEMENT, such dispute shall first be addressed by negotiation between the parties. In the event that the parties cannot resolve their disagreement by negotiation, either party, upon written notice, may request mediation or arbitration before the American Arbitration Association. Such mediation or arbitration shall be non-binding and shall be held in North County.

SECTION 25. PARTIES TO BEAR OWN COSTS OF MAINTAINING PERMITS.

LEUCADIA and the WATER DISTRICT shall each, respectively, pay all costs of maintaining their own permits to carry out the project.

IN WITNESS WHEREOF, the parties hereto have caused this AGREEMENT to be executed and be effective on the date first above mentioned.

LEUCADIA:

By: _____
President

ATTEST:

_____
General Manager

Date: 3/15/91

WATER DISTRICT:

By: _____

ATTEST:

_____
City Clerk

Date: 3/25/91

(Doc:LCWD010.cln/E.4-3)
(Rev. 3/07/91)

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ORDER NO. 87-82

WASTE DISCHARGE REQUIREMENTS
FOR
LEUCADIA COUNTY WATER DISTRICT
FOREST R. GAFNER WATER RECLAMATION PLANT
NEAR THE CITY OF CARLSBAD
SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

1. On May 21, 1979, this Regional Board adopted Order No. 79-35, *Waste Discharge Requirements for Leucadia County Water District Forest R. Gafner Water Reclamation Plant Near City of Carlsbad.* Order No. 79-35 established requirements for the disposal of treated domestic sewage by irrigation of the 250 acre La Costa Golf Course.

2. On June 29, 1981, this Regional Board adopted Addendum No. 1 to Order No. 79-35, *An Addendum Modifying Order No. 79-35 to Allow for Reduced Flood Protection for the La Costa Golf Course Lake for the Leucadia County Water District Forest R. Gafner Water Reclamation Plant Near the City of Carlsbad, San Diego County.* Addendum No. 1 to Order No. 79-35 amended Discharge Specifications B.10 and B.11 as follows:

> "10. All waste treatment, containment and disposal facilities with the exception of irrigation areas and the La Costa Golf Course reservoir, shall be protected against 100-year peak stream flows as defined by the San Diego County floor control agency.
>
> "11. All waste treatment, containment and disposal facilities with the exception of irrigation areas and the La Costa Golf Course reservoir, shall be protected against erosion, overland runoff and other impacts resulting from a 100-year frequency 24-hour storm."

Addendum No. 1 to Order No. 79-33 also added two new Discharge Specifications B.17 and B.18 which are as follows:

> "17. The La Costa Golf Course reservoir shall be at all times protected against erosion, flooding, overland runoff resulting from a 2-year frequency 24-hour storm.
>
> "18. The discharger is prohibited from discharging treated wastewater effluent to the La Costa Golf Course reservoir from November 1 through March 30. Prior to

November 1, the discharger shall complete the 7-day schedule of withdrawing approximately 99 percent of the wastewater contained in the pond and replacing the wastewater with potable water as described in the findings of this Addendum,"

3. As a part of the FY 1986/87 Waste Discharge Order Update program, Order No. 79-35 and Addendum thereto have been reviewed by Regional Board staff in accordance with criteria established in the Administrative Procedures Manual adopted by the State Water Resources Control Board. As a result of this review, it has been determined that no major changes are necessary in the requirements established by Order No. 79-35 and Addendum thereto. This Order, which supersedes Order No. 79-35 and Addendum thereto, consolidates and makes minor editorial changes in the findings, requirements, and monitoring and reporting program of Order No. 79-35 and Addendum thereto. The findings which follow are, for the most part, findings taken from Order No. 79-35 and Addendum thereto which outline the history of and basis for the requirements established for the discharge of reclaimed wastewater from the Leucadia County Water District Forest R. Gafner Water Reclamation Plant to the La Costa Golf Course.

4. Mr. Richard E. Hanson, Secretary-Manager, Leucadia County Water District (LCWD), submitted an incomplete Report of Waste Discharge dated March 16, 1979, proposing to reactivate the existing Forest R. Gafner Water Reclamation Plant to provide up to 0.75 million gallons per day (MGD) of secondarily treated wastewater for the irrigation of the 250-acre La Costa Golf Course which is located within the City of Carlsbad in San Diego County. After receipt of additional information requested by staff, the complete Report of Waste Discharge was accepted on May 10, 1979.

5. The LCWD proposes to operate the treatment plant similar to the manner it was operated before it was taken out of service in 1975. Effluent from the plant would be chlorinated and pumped to a small lake in the La Costa Golf Course; the lake would hold the effluent until being repumped for irrigation.

6. The LCWD reports that the treatment facility has been operational since November 1977, treating between 0.35 and 0.75 MGD to provide flow equalization for the existing (low capacity) 12-inch and 14-inch force mains to the Encina Joint Powers Regional Severage Agency (JPRSA) treatment and disposal facilities. A new 24-inch raw sewage force main has been constructed and should be operational in the near future.

7. The discharger reports that a fail-safe connection to the Encina JPRSA's ocean outfall will be constructed utilizing the LCWD existing 12-inch and 14-inch force mains. The fail-safe connection to the ocean outfall would be used to dispose of effluent when irrigation of the La Costa Golf Course could not occur.

8. The LCWD reports that if the District does not contract with the La Costa Land Company for reclaimed water use or if the contract is terminated in the future, then the fail-safe connection to the Encina JPRSA ocean outfall would be used on a continual basis.

9. By letter dated April 19, 1979, Mr. Les Evans, General Manager, Encina JPRSA, reported that the Encina Joint Advisory Committee considered the question of use of the ocean outfall as a fail-safe effluent disposal system for upstream treatment plants. Mr. Evans reported that the Committee unanimously agreed that the ocean outfall could be utilized to the extent of each agencies' ownership. The discharge by the LCWD to the Pacific Ocean via the Encina Ocean Outfall is currently regulated by this Regional Board's Order No. 84-35 (NPDES Permit No. CA0107395).

10. The LCWD proposes to treat Green Valley area wastewater in the treatment plant since this area produces wastewater with a lower total dissolved solids (TDS) concentration than the La Costa drainage portion of the District. The LCWD reports that an effluent containing approximately 1,000 milligrams per liter (mg/l) would be produced. The LCWD reports that existing Ordinance No. 10 prohibits the discharge of self-regenerated water softener brine into the sewerage system thus helping to ensure continued low TDS effluent.

11. The discharger reports that the golf course reservoir will be protected from flooding from a 100-year frequency stream flow in San Marcos Creek by a grassy earth berm. This feature would prevent the reservoir contents from entering San Marcos Creek and Batiquitos Lagoon during storm conditions.

12. The LCWD proposes to discharge solids collected and generated in the treatment process to the new raw sewage force main for treatment at the Encina JPRSA's treatment plant.

13. The discharger reports that the treatment plant would be upgraded with the installation of odor controlling covers around the headworks, the primary clarifier, and trickling filter. Air from these three covers would be collected and treated in a soil filter bed to destroy offensive odors. In addition, back-up activated carbon odor removal facilities would be provided as a fail-safe odor control measure. The Leucadia Pump Station vents would also be piped to the air treatment facility.

14. The Report of Waste Discharge did not adequately address the wastewater reuse area. Additional information needed includes soil permeability, wastewater application rates, sprinkler layout, detailed description of areas of use, and degree of public contact. The LCWD has been informed of the need for this additional information before the discharge can be initiated. As a result, the Regional Board staff in cooperation with the State and County Health Department staffs will review and approve the specific disposal concepts, including ability of the soil to accept the discharge and whether the proposed degree of treatment is adequate. The LCWD has been notified that this information could reveal that the discharge to the golf course cannot be initiated.

15. The discharger reports that water is supplied to the area tributary to the reclamation plant by the Olivenhain Municipal Water District.

16. The Forest R. Gafner Water Reclamation Plant and La Costa Golf Course are located near the banks of San Marcos Creek immediately upstream of Batiquitos Lagoon, Sections 35 and 36, T12S, R4W, SBB&M. The wastewater reclamation project is located in an area with no ground water quality objectives in the Batiquitos Hydrologic Subarea of the San Marcos Hydrologic Subunit of the Carlsbad Hydrologic Unit.

17. The *Comprehensive Water Quality Control Plan Report, San Diego Basin (3)* (Basin Plan), was adopted by this Regional Board on March 17, 1975; approved by the State Water Resources Control Board (State Board) on March 20, 1975; and updated by the Regional Board on February 27, 1978; March 23, 1981; January 24 and October 3, 1983; August 27, 1984, and December 16, 1985. The 1978, 1981, 1983, 1984 and 1985 updates were subsequently approved by the State Board.

18. The Basin Plan established the following objectives for surface and ground waters in the San Marcos Hydrologic Subunit:

	Concentrations not to be exceeded more than 10 percent of the time			
Constituent	Surface water		Ground Water*	
Total Dissolved Solids	500	mg/l	1000	mg/l
Chloride	250	mg/l	400	mg/l
Percent Sodium	60		60	
Sulfate	250	mg/l	500	mg/l
Nitrate	—		10	mg/l
Nitrogen and Phosphorus	**		--	
Iron	0.3	mg/l	--	
Manganese	0.05	mg/l	0.05	mg/l
Methylene Blue Active Substances	0.5	mg/l	0.5	mg/l
Boron	0.5	mg/l	0.5	mg/l
Dissolved Oxygen	***			
Odor	None		None	
Turbidity	20	NTU	5	NTU
Color	20	Units	15	Units
Fluoride	1.0	mg/l	1.0	mg/l

* The ground water objectives do not apply between Highway 78 and El Camino Real, westerly of the easterly boundary of Interstate Highway 5 and to all lands which drain to Moonlight Creek and Encinitas Creek.

Note: NTU = Nephelometric Turbidity Units

** Concentrations of nitrogen and phosphorus, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth. Threshold total phosphorus (P) concentrations shall not exceed 0.05 mg/l in any stream at the point where it enters any standing body of water, nor 0.025 mg/l in any standing body of water.

*** Ninety percent or more of natural seasonal minimum oxygen concentration and more than 5.0 mg/l maintained at least 90 percent of the time.

19. The Basin Plan also contains the following prohibitions applicable to the proposed discharge:

> "Discharge of treated or untreated sewage or industrial wastewater, exclusive of cooling water or other waters which are chemically unchanged, to a watercourse, is prohibited except in cases where the quality of said discharge complies with the receiving body's water quality objectives.
>
> "Discharging of treated or untreated sewage or industrial wastes in such manner or volume as to cause sustained surface flow or ponding on lands not owned or under the control of the discharger is prohibited except in cases defined in the previous paragraph and in cases in which the responsibility for all downstream adverse effects is accepted by the discharger."

20. Surface waters in the San Marcos Hydrologic Subunit are beneficially used for:

a. Agricultural supply
b. Water contact recreation
c. Nonwater contact recreation
d. Warm freshwater habitat
e. Wildlife habitat
f. Preservation of rare and endangered species

21. Ground waters in the San Marcos Hydrologic Subunit are beneficially used for:

a. Municipal and domestic supply
b. Agricultural supply
c. Industrial service supply

22. The discharge of reclaimed wastewater from LCWD Forest R. Gafner Water Reclamation Plant to the La Costa Golf Course for irrigation will not unreasonably affect the present and anticipated beneficial uses of surface or groundwater located at, or down gradient of, the irrigation area. Also the discharge will not cause any violation of groundwater objectives as identified in the Basin Plan. In light of the Above information, it has been determined that the discharge as regulated by this Order is consistent with the State Water Resources Control Board Resolution 68-16 *Statement of Policy with Respect to maintaining High Quality of Waters in California*

23. The LCWD has prepared a final environmental impact report in accordance with the California Environmental Quality Act (Public Resources Code Section 21000 et seq.) and the State Guidelines.

24. The project as approved by the LCWD would have the following significant effects on the environment:

    a. The growth within the District's service area will be dictated largely by the following plans and documents: San Dieguito Community Plan; City of Carlsbad General Plan; La Costa Master Development Plan; Regional Growth Management Plan; Local Coastal Program--San Dieguito; Air Quality Strategies; and Areawide Water Quality Management Plan. The provision of an additional 0.75 MGD of sewer capacity is only one of many influences that would shape land use. The District has existing commitments for the 0.75 MGD capacity and no new commitments would be made in connection with the proposed reclamation project.

    b. Energy consumption of the area would increase with the population growth provided by the reactivation of the water reclamation system.

25. The LCWD reports that no practical methods are available to prevent the increases in energy consumption and growth resulting from the proposed project. Adherence to land use strategies previously mentioned (Finding 23(a)) for the LCWD service area should mitigate excess and uncontrolled growth and development in the LCWD.

26. The Regional Board, in establishing the requirements contained herein, considered factors including, but not limited to the following:

    a. Beneficial uses to be protected and the water quality objectives reasonably required for that purpose;
    b. Other waste discharges
    c. The need to prevent nuisance;
    d. Past, present and probable future beneficial uses;
    e. Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
    f. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
    g. Economic considerations; and
    h. The need for developing housing within the Region.

27. This facility is an existing facility and as such is exempt from the provisions of the California Environmental Quality Act, in accordance with Title 14, California Administrative Code, Chapter 3, Article 19, Section 15301.

28. The Regional Board has considered all water resource related environmental factors associated with the discharge of waste.

29. The Regional Board has notified the discharger and all known interested parties of its intent to update waste discharge requirements for the discharge.

30. The Regional Board in a public meeting heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, That the Leucadia County Water District (hereinafter discharger), in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. PROHIBITIONS

1. Discharges of wastes, including windblown spray and runoff of effluent applied for irrigation, to lands which have not been specifically described to the Regional Board and for which valid waste discharge requirements are not in force are prohibited.

2. The discharge of any radiological, chemical or biological warfare agent, or high-level radiological waste is prohibited.

3. The disposal of wastewater in a manner that would result in ponding or surfacing of wastewater on lands beyond the disposal area, as described in the findings of this Order, is prohibited.

4. The discharge of wastewater or sludge shall not:

   a. Cause the occurrence of coliform or pathogenic organisms in waters pumped from the basin;

   b. Cause the occurrence of objectionable tastes and odors in water pumped from the basin;

   c. Cause waters pumped from the basin to foam;

   d. Cause the presence of toxic materials in waters pumped from the basin;

   e. Cause the pH of waters pumped from the basin to fall below 6.0 or rise above 9.0;

   f. Cause this Regional Board's objectives for the ground or surface waters of the San Marcos Hydrologic Subunit as established in the Basin Plan, to be exceeded;

   g. Cause odors, septicity, mosquitos or other vectors, weed growth or other nuisance conditions in San Marcos Creek or its tributaries; or

   h. Cause a surface flow recognizable as sewage in San Marcos Creek or its tributaries.

5. The discharge of a waste flow volume in excess of 0.75 MGD is prohibited unless the discharger obtains revised waste discharge requirements for the proposed increased flow.

6. Odors, vectors, and other nuisances of sewage or sewage sludge origin beyond the limits of the treatment plant site or disposal area are prohibited.

7. The bypassing of untreated or partially treated wastewater from the wastewater treatment facility or any intermediate unit process is prohibited.

8. The discharge of waste in a manner other than as described in the findings of this Order is prohibited unless the discharger obtains revised waste discharge requirements that provide for the proposed change.

9. The discharge of treated or untreated wastewater to San Marcos Creek or its tributaries is prohibited.

10. Land disposal of wastewater by irrigation in areas for which water reclamation requirements have not been issued is prohibited. Disposal of wastewater to land other than as authorized by waste discharge requirements issued by this Regional Board is prohibited. Disposal of wastewater to waters of the United States other than as authorized by an NPDES permit issued by this Regional Board is prohibited.

B. DISCHARGE SPECIFICATIONS

1. Concentrations of mineral constituents in the discharges from the wastewater treatment plant shall not exceed the following:

Constituent	Increment over water supply*	
Total Dissolved Solids	400	mg/l
Chloride	200	mg/l
Sulfate	100	mg/l
Sodium	200	mg/l

* This requirement is based on quarterly analysis of the water supply of the area tributary to the treatment plant and disposal facilities.

2. All waste treatment, containment and disposal facilities with the exception of irrigation areas, and the La Costa Golf Course reservoir shall be protected against 100-year peak stream flows as defined by the San Diego County flood control agency.

3. All waste treatment, containment and disposal facilities with the exception of irrigation areas, and the La Costa Golf Course reservoir shall be protected against erosion, overland runoff, and other impacts resulting from a 100-year frequency 24-hour storm.

4. Collected screenings, sludges, other solids removed from liquid wastes, and filter backwash shall be disposed of in a manner approved by the Executive Officer of the Regional Board.

5. Effluent used for irrigation shall conform with all applicable provisions of California Administrative Code, Title 22, Division 4, Chapter 3 (*Wastewater Reclamation Criteria*) in its present form or as it may be amended.

6. Adequate facilities shall be provided to contain or dispose of effluent during wet weather periods and other periods when irrigation demand is less than the reclaimed water supply.

7. Effluent used in recreational impoundments shall at all times conform with the provisions of Article 5, Title 22, Division 4, of the California Admianistrative Code in their present form or as they may be amended.

8. Sampling of effluent shall at least be conducted as specified in Article 6, Title 22, Division 4, of the California Administrative Code in its present form or as it may be amended.

9. The La Costa Golf Course reservoir shall be at all times protected against erosion, flooding, overland runoff resulting from a 2-year frequency 24-hour storm.

10. The discharger is prohibited from discharging treated wastewater effluent to the La Costa Golf Course reservoir from November 1 through March 30. Prior to November 1, the discharger shall complete the 7-day schedule of withdrawing approximately 99 percent of the wastewater contained in the pond and replacing the wastewater with potable water as described in the findings of this Order.

11. The monthly average concentration of 5day 20° Centigrade biochemical oxygen demand in the discharge to the irrigation or storage facilities or to the ocean outfall shall not exceed 30 mg/l as determined from a 24-hour proportioned-to-flow composite sample. The daily maximum concentration shall not exceed 50 mg/l as determined in any single grab sample or 24-hour composite sample.

12. The concentration of suspended solids in the discharge to the irrigation or storage facilities or to the ocean outfall shall not exceed 30 mg/l as determined from a 24-hour proportioned-to-flow composite sample. The daily maximum concentration shall not exceed 50 mg/l as determined in any single grab sample or 24-hour composite sample.

13. The storage pond shall be so managed that a dissolved oxygen concentration of not less than 2.0 mg/l is maintained in it at all times.

C. PROVISIONS

1. Neither the treatment nor the discharge of waste shall create a pollution, contamination or nuisance, as defined by Section 13050 of the California Water Code.

2. Reclaimed water shall not be supplied to parties who use, transport, or store such water in a manner which causes a pollution, contamination or nuisance, as defined by Section 13050 of the California Water Code.

3. The discharger must comply with all conditions of this Order. Any noncompliance with this Order constitutes a violation of the California Water Code and is grounds for (a) enforcement action; (b) termination, revocation and reissuance, or modification of this Order; or (c) denial of a Report of Waste Discharge renewal application.

4. In an enforcement action, it shall not be a defense for the discharger that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with this Order. Upon reduction, loss, or failure of the treatment facility, the discharger shall, to the extent necessary to maintain compliance with this Order, control production or all discharges, or both, until the facility is restored or an alternative method of treatment is provided. This provision applies for example, when the primary source of power of the treatment facility fails, is reduced, or is lost.

5. The discharger shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this Order, including such accelerated or additional monitoring as may be necessary to determine the nature and impact of the noncomplying discharge.

6. The discharger shall, at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with conditions of this Order. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Order.

7. This Order may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

   a. Violation of any terms or conditions of this Order;

   b. Obtaining this Order by misrepresentation or failure to disclose fully all relevant facts; or

   c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge. The filing of a request by the discharger for the modification,

revocation and reissuance, or termination of this Order, or notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

8. This Order is not transferrable to any person except after notice to the Executive Officer. The Regional Board may require modification or revocation and reissuance of this Order to change the name of the discharger and incorporate such other requirements as may be necessary under the California Water Code. The discharger shall submit notice of any proposed transfer of this Order's responsibility and coverage to a new discharger as described under Reporting Requirement D.3.

9. This Order does not convey any property rights of any sort or any exclusive privileges. The requirements prescribed herein do not authorize the commission of any act causing injury to persons or property, nor protect the discharger from liability under federal, state or local laws, nor create a vested right for the discharger to continue the waste discharge.

10. The discharger shall allow the Regional Board, or an authorized representative upon the presentation of credentials and other documents as may be required by law, to:

    a. Enter upon the discharger's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Order;

    b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order;

    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

    d. Sample or monitor at reasonable times, for the purposes of assuring compliance with this Order or as otherwise authorized by the California Water Code, any substances or parameters at any location.

11. The discharger's wastewater treatment facilities shall be supervised and operated by persons possessing certificates of appropriate grade pursuant to Chapter 3, Subchapter 14, Title 23 of the California Administrative Code.

12. A copy of this Order shall be maintained at the Leucadia County Water District Forest R. Gafner Water Reclamation plant and shall be available to operating personnel at all times.

13. The requirements prescribed by this Order supersede the requirements prescribed by Order No. 79-35 and Addendum thereto. Order No. 79-35 and Addendum thereto are hereby rescinded when this Order becomes effective.

14. The provisions of this Order are severable, and if any provision of this Order, or the application of any provision of this Order to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this Order, shall not be affected thereby.

15. The potable water supply shall not be used to supplement the reclaimed water supply except through an approved air gap. In other areas where the potable water supply is piped to premises where sewage is pumped, treated or reclaimed (i.e., sewage treatment plants or pumping stations, golf course, etc.) the potable water supply shall be protected at the property line in accordance with the State Department of Health Services' *Regulations Relating to Cross-Connections*.

16. All irrigation with reclaimed water shall be done by the discharger or by parties which have obtained authorization from the discharger and water reclamation requirements from this Regional Board.

17. Reclaimed water shall only be supplied to and used in areas for which valid waste discharge requirements, as established by this Order and subsequent addenda, are in force. Prior to using reclaimed water or supplying reclaimed water for use by other parties in any manner or in any area other than as described in the findings of this Order, the discharger shall obtain proper authorization from this Regional Board. The discharger shall not supply reclaimed water to any party until and unless such party obtains water reclamation requirements from this Regional Board.

18. Reclaimed water use shall be in conformance with *Guidelines for Use of Reclaimed Water for Irrigation and Impoundments* and *Guidelines for Worker Protection at Water Reclamation Use Areas* prepared by the State Department of Health Services.

19. If the discharger is supplying reclaimed water for use by other parties, the discharger shall establish rules and regulations governing the design and operation of reclaimed water use facilities. The rules and regulations shall be developed in conformance with *Guidelines for Use of Reclaimed Water for Irrigation and Impoundments* and *Guidelines for Worker Protection at Water Reclamation Use Areas* prepared by the State Department of Health Services.

20. If the discharger is using reclaimed water, the discharger shall designate a reclaimed water supervisor responsible for the reclaimed water system at each use area under the discharger's control. If the discharger is supplying reclaimed water for use by another party, the discharger shall require that each such user designate a reclaimed water supervisor responsible for the reclaimed water system at each use area under the user's control. Reclaimed water supervisors should be responsible for the installation,

operation, and maintenance of the irrigation system, enforcement of rules and regulations, prevention of potential hazards, and maintenance of the distribution system plans in "as-built" form.

D. REPORTING REQUIREMENTS

1. The discharger shall file a new Report of Waste Discharge at least 120 days prior to the following:

   a. Addition of a major industrial waste discharge of essentially domestic sewage, or the addition of a new process or product by an industrial facility resulting in a change in the character of the wastes.

   b. Significant change in the treatment or disposal method (e.g., change in the method of treatment which would significantly alter the nature of the waste).

   c. Change in the disposal area from that described in the findings of this Order.

   d. Increase in flow beyond that specified in this Order.

   e. Other circumstances which result in a material change in character, amount, or location of the waste discharge.

   f. Any planned change in the regulated facility or activity which may result in noncompliance with this Order.

2. The discharger shall furnish to the Executive Officer of this Regional Board, within a reasonable time, any information which the Executive Officer may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order. The discharger shall also furnish to the Executive Officer, upon request, copies of records required to be kept by this Order.

3. The discharger must notify the Executive Officer, in writing at least 30 days in advance of any proposed transfer of this Order's responsibility and coverage to a new discharger. The notice must include a written agreement between the existing and new discharger containing a specific date for the transfer of this Order's responsibility and coverage between the current discharger and the new discharger. This agreement shall include an acknowledgement that the existing discharger is liable for violations up to the transfer date and that the new discharger is liable from the transfer date on.

4. The discharger shall comply with the attached Monitoring and Reporting Program No. 87-82. Monitoring results shall be reported at the intervals specified in Monitoring and Reporting Program No. 87-82.

5. If a need for a discharge bypass is known in advance, the discharger shall submit prior notice and, if at all possible, such notice shall be submitted at least 10 days prior to the date of the bypass.

6. Where the discharger becomes aware that they failed to submit any relevant facts in a Report of Waste Discharge or submitted incorrect information in a Report of Waste Discharge or in any report to the Regional Board, they shall promptly submit such facts or information.

7. The discharger shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally to the Executive Officer within 24 hours from the time the discharger becomes aware of the circumstances. A written submission shall also be provided within five days of the time the discharger becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected; the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. The Executive Officer, or an authorized representative, may waive the written report on a case-by-case basis if the oral report has been received within 24 hours. The following occurrence(s) must be reported to the Executive Officer within 24 hours:

   a. Any bypass from any portion of the treatment facility.

   b. Any discharge of treated or untreated wastewater resulting from sewer line breaks, obstruction, surcharge or any other circumstances.

   c. Any treatment plant upset which causes the effluent limitations of this Order to be exceeded.

8. The discharger shall file a written report with this Regional Board within 90 days after the average dry weather waste flow for any month equals or exceeds 75 percent of the design capacity of the waste treatment and/or disposal facilities. The discharger's senior administrative officer shall sign a letter which transmits that report and certifies that the policy-making body is adequately informed. The report shall include:

   a. Average daily flow for the month, the date on which the instantaneous peak flow occurred, the rate of that peak flow, and the total flow for that day.

   b. The discharger's best estimate of when the average daily dry weather flow rate will equal or exceed the design capacity of the facilities.

c. The discharger's intended schedule for studies, design, and other steps needed to provide additional capacity for the waste treatment and/or disposal facilities before the waste flow rate equals the capacity of present units.

9. The discharger shall prepare an engineering report as required by Section 60323 of *Wastewater Reclamation Criteria*. This report shall be prepared in conformance with *Guidelines for the Preparation of an Engineering Report Pursuant to the Production, Distribution, and Use of Reclaimed Wastewater* prepared by the State Department of Health Services. This report shall be submitted to this Regional Board, the State Department of Health Services, and the San Diego County Department of Health Services. The use of reclaimed water shall not be initiated until this report is accepted by the Executive Officer.

10. The rules and regulations required by Provision C.19 shall be submitted to this Regional Board, the State Department of Health Services, and the San Diego County Department of Health Services. The use of reclaimed water shall not be initiated until this engineering report is accepted by the Executive Officer.

11. The discharger shall notify the Executive Officer by letter of the following:

a. Start of construction of waste treatment and reclaimed water use facilities;

b. Estimated date construction will be completed;

c. Completion of construction of waste treatment and reclaimed water use facilities; and

d. Estimated date the completed facilities will commence operation.

12. A report certifying the adequacy of each component of the treatment and disposal facilities shall be submitted by the discharger prior to commencement of the discharge. This certification report shall contain a requirement-by-requirement analysis, based on accepted engineering practice, of how the process and physical design of the facilities will ensure compliance with this Order. The design engineer shall affix his/her signature and engineering license number to this certification report. This report should be submitted prior to construction of the facilities. The discharge shall not be initiated until:

a. The certification report is accepted by the Executive Officer;

b. The Executive Officer has been notified of the completion of facilities by the discharger;

c. An inspection of the facilities has been made by Regional Board staff; and

d. Regional Board staff has notified the discharger by letter that the discharge can be initiated.

13. All applications, reports, or information submitted to the Executive Officer shall be signed and certified as follows:

a. The Report of Waste Discharge shall be signed as follows:

(1) *For a corporation* - by a principal executive officer of at least the level of vice-president.

(2) *For a partnership or sole proprietorship* - by a general partner or the proprietor, respectively.

(3) *For a municipality, state, federal or other public agency* -by either a principal executive officer or ranking elected official.

b. All other reports required by this Order and other information required by the Executive officer shall be signed by a person designated in paragraph (a) of this provision, or by a duly authorized representative of that person. An individual is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph (a) of this provision;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity; and

(3) The written authorization is submitted to the Executive Officer.

14. The discharger shall submit reports required under this Order, or other information required by the Executive Officer, to:

Executive Officer
California Regional Water Quality Control Board
San Diego Region
9771 Clairemont Mesa Boulevard - Suite B
San Diego, California 92124-1331

E. NOTIFICATIONS

1. These requirements have not been officially reviewed by the United States Environmental Protection Agency and are not issued pursuant to Section 402 of the Clean Water Act.

2. The California Water Code provides that any person who intentionally or negligently violates any waste discharge requirements issued, reissued, or amended by this Regional Board is subject to a civil monetary remedy of up to 20 dollars per gallon of waste discharged or, if a cleanup and abatement order is issued, up to 15,000 dollars per day of violation or some combination thereof.

3. The California Water Code provides that any person failing or refusing to furnish technical or monitoring program reports, as required under this Order, or falsifying any information provided in the monitoring reports is guilty of a misdemeanor.

I, Ladin H. Delaney, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Diego Region on May 4, 1987.

LADIN H. DELANEY
Executive Officer

WP:hd

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

MONITORING AND REPORTING PROGRAM NO. 87-82
FOR
LEUCADIA COUNTY WATER DISTRICT
FOREST R. GAFNER WATER RECLAMATION PLANT
NEAR THE CITY OF CARLSBAD
SAN DIEGO COUNTY

GENERAL PROVISIONS FOR SAMPLING AND ANALYSIS

Unless otherwise noted, all sampling, sample preservation, and analyses shall be conducted in accordance with the current edition of "Guidelines Establishing Test Procedures for Analysis of Pollutants," promulgated by the United States Environmental Protection Agency, or approved by the Executive Officer.

All analyses shall be performed in a laboratory certified to perform such analyses by the California Department of Health or a laboratory approved by the Executive Officer.

Samples shall be 24-hour proportioned-to-flow composite samples unless otherwise specified. All grab samples shall be representative of the waste discharge under the conditions of peak load.

GENERAL PROVISIONS FOR REPORTING

For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time and submit a timetable for correction.

By January 30 of each year, the discharger shall submit an annual summary report to the Regional Board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the discharger shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

The discharger shall file a written report within 90 days after the average dry weather flow, for any month, equals or exceeds 70 percent of the design capacity of the waste treatment or disposal facilities. The report shall contain a schedule for studies, design, and other steps needed to provide additional capacity or limit the flow below the design capacity prior to the time when the waste flow rate equals the capacity of the present units.

MONITORING PROGRAM

The discharger shall submit technical reports concerning the quantity and quality of the discharge, using the attached format, in accordance with the following schedule.

EFFLUENT

1. Effluent examination shall be conducted for the following items at the frequency shown, and reported at monthly intervals:

Determination	Unit	Frequency
pH	Units	Daily 1/
5-day 20° Centigrade biochemical oxygen demand	mg/l	Daily 1/
Suspended solids - Total	mg/l	Daily 1/
Suspended solids - Volatile	mg/l	Daily 1/
Total dissolved solids	mg/l	Monthly
Chloride	mg/l	Monthly
Sulfate	mg/l	Monthly
Sodium	mg/l	Monthly
Fluoride	mg/l	Monthly
Boron	mg/l	Monthly
Synthetic detergents	mg/l	Monthly
Dissolved oxygen*	mg/l	Daily 1/
Percent sodium		Monthly
Coliforms, total*	MPN/100 ml.	**
Settleable solids*	ml/l	Daily 1/
Turbidity	NTU	Daily 1/
Chlorine residual*	mg/l	Daily 1/
Grease and oil*	mg/l	Daily 1/
Ammonia (as N)	mg/l	Quarterly
Cyanide	mg/l	Quarterly
Metals		
Arsenic	mg/l	Quarterly
Cadmium	mg/l	Quarterly
Chromium, total	mg/l	Quarterly
Copper	mg/l	Quarterly
Lead	mg/l	Quarterly
Mercury	mg/l	Quarterly
Nickel	mg/l	Quarterly
Silver	mg/l	Quarterly
Zinc	mg/l	Quarterly
Chromium Hexavalent	mg/l	Quarterly
Phenolic compounds	mg/l	Quarterly

Note: mg/l = milligrams per liter ml/l = milliliters per liter
MPN/100 ml. = Most Probable Number per 100 milliliters NTU = Nephelometric Turbidity Units

* Grab sample at high flow times

** Effluent sampling shall at least be conducted as specified in California Administrative Code, Title 22, Division 4, Chapter 3, *Wastewater Reclamation Criteria* in its present form or as it may be amended.

1/ Monday, Wednesday and Friday

2. A daily log of the volume of water discharged through the irrigation systems and the areas irrigated shall be reported monthly.

3. Volume of effluent flow from the treatment plant shall be measured and recorded continuously. Volume of flow for each day shall be reported to the Regional Board monthly.

INFLUENT

Determination	Unit	Frequency
5-day 20° Centigrade biochemical oxygen demand	mg/l	Monthly
Suspended solids - Total	mg/l	Monthly
Suspended solids - Volatile	mg/l	Monthly

STORAGE FACILITIES

When the storage facilities are in use, dissolved oxygen concentrations shall be determined at least daily on grab samples taken at the surface and bottom, not later than 8:00 a.m., and reported monthly to the Regional Board. The samples shall be collected from the deepest portion of the storage facilities.

POTABLE SUPPLY WATERS

Examination of the potable water supplied to the service area of the Leucadia County Water District wastewater treatment facilities shall be conducted for the following items quarterly with the results reported quarterly:

Constituent	Unit
Total dissolved solids	mg/l
Chloride	mg/l
Sulfate	mg/l
Sodium	mg/l

PLANT MONITORING

1. Wind direction and velocity - The district shall record daily readings from an anemograph at the plant.

2. Plant site inspection - Twice each day at periods of minimum wind velocity, an inspection by the district shall be around the perimeter of the plant site for the purpose of detecting any of the following odors, the absence or presence of which is logged as to location and is rated as to degree on a scale of 1-10: a) damp-musty; b) raw sewage; c) sludge; and d) hydrogen sulfide.

ODOR PROBLEMS

1. Customer complaints - A log shall be kept of names and addresses of complaintants and location and description of odors.

2. Field investigation - The District shall investigate any odor complaint as soon as possible after it is received. The investigation shall include a one-half block radius in the vicinity of the location and the results of the investigation shall be entered in the log.

3. Plant investigation - When possible, complaintant shall be invited to the plant site to help the district identify the odor source. Findings shall be entered in the log. If more than one complaint is received at any one time, a district employee will be dispatched to poll the neighborhood to solicit any additional odor complaints. These findings shall be entered in the log.

4. Corrections - If the detected odor is determined to have originated from the plant site, immediate measures shall be taken to correct the problem.

PUBLIC AWARENESS

All residents and commercial customers within a one-half mile radius of the plant site shall be notified annually of the establishment of the Odor Monitoring Program and of the appointment of two of their neighbors to serve on the Odor Monitoring Committee.

REPORT

A monthly report shall be made to the Regional Board indicating the absence or presence of odors detected outside the plant site during the month by residents and the steps taken to correct any odor problems.

LADIN H. DELANEY
Executive Officer
May 4, 1987

WP:hd

DEPARTMENT OF HEALTH SERVICES
SANITARY ENGINEERING SECTION
1350 Front Street, Room 2050
San Diego, CA 92101
Telephone: (714) 237-7391

RECEIVED MAR 2 1 1980

Gregory W. McBain, Office Manager
Engineering-Science
11750 Sorrento Valley Rd., Suite 220
San Diego, CA 92121

March 20, 1980

Subject: Degree of Treatment Required for Reclamation at La Costa Golf Course

On May 10, 1979, Mrs. Diana Barich of our staff conducted an inspection of the proposed reclamation area. Along the perimeter of the golf course are single family homes and condominiums, some of which have no demarcation between their yard and the golf course. Furthermore, San Marcos Creek runs through the center of the course. It is our opinion that these physical features make it virtually impossible to irrigate the course without substantial direct public contact with the reclaimed water and/or a discharge to San Marcos Creek. It should be noted that the "Intent of Regulations" prefacing the Wastewater Reclamation Criteria contains the following statement:

> "Precautions must be taken to avoid direct public contact with reclaimed waters which do not meet the standards in Article 5 for non-restricted recreational impoundments."

In consideration of the foregoing and in accordance with the declared intent of the regulations, it is our determination that the wastewaters used to irrigate La Costa Golf Course shall meet the specification prescribed in Subsection (b) of Section 60313 of Title 22 — Wastewater Reclamation Criteria (copy enclosed). We fully support the concept of using reclaimed water for irrigation of landscaped areas in lieu of imported water. A significant quantity of imported water can be conserved by the use of reclaimed water; however, for public health protection, it is essential that the reclaimed water used for golf course irrigation in residential developments meet the higher quality requirements.

If you have questions regarding this matter, please contact Diana Barich at the above number.

Kirkham W. Campbell

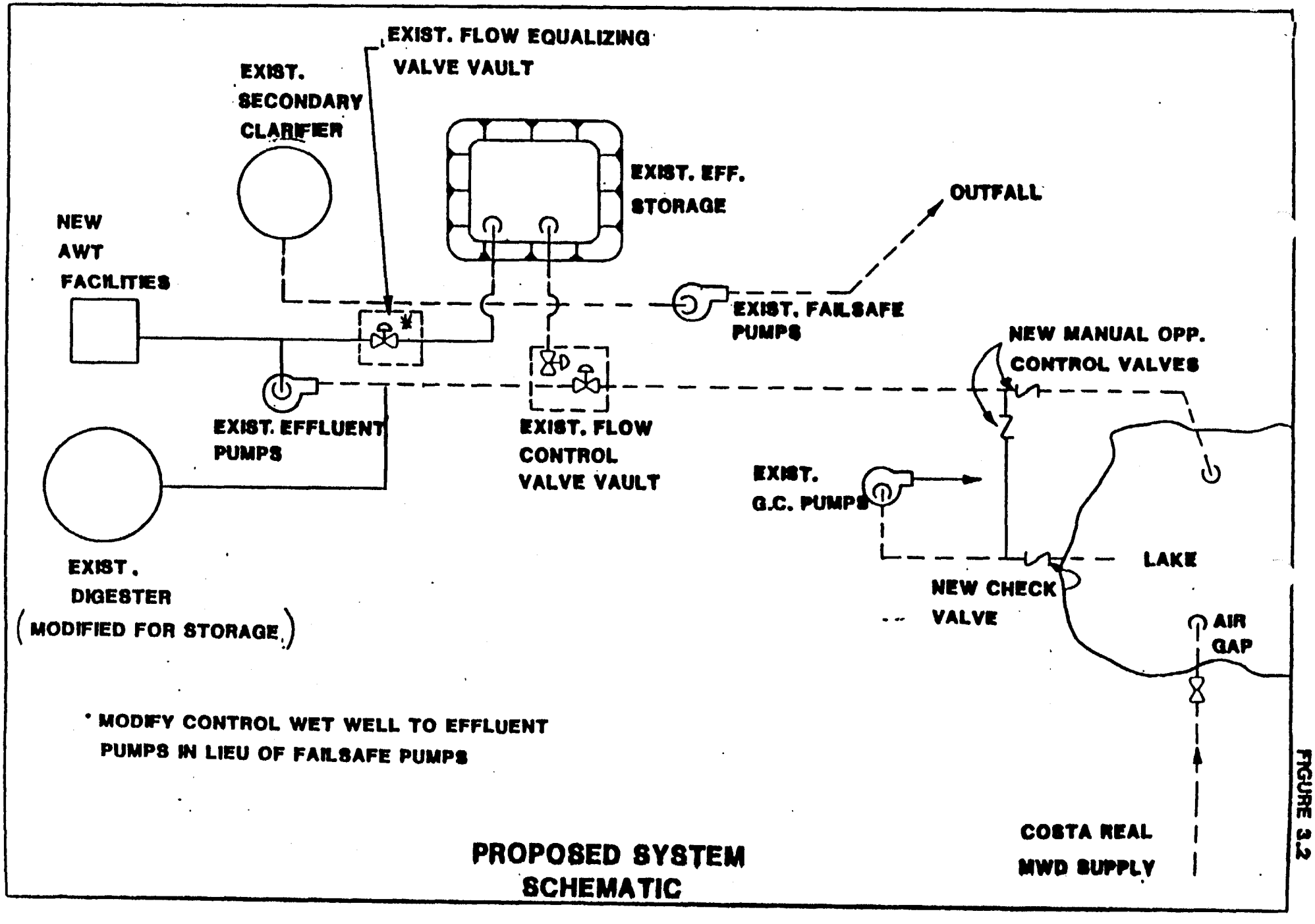
KWC:DLB:tr

Kirkham W. Campbell
District Engineer

Enclosure

cc: Leucadia County Water District
San Diego Regional Water Quality Control Board
San Diego County Dept. of Health Services

EXHIBIT "B"



PROPOSED SYSTEM SCHEMATIC

FIGURE 3.2

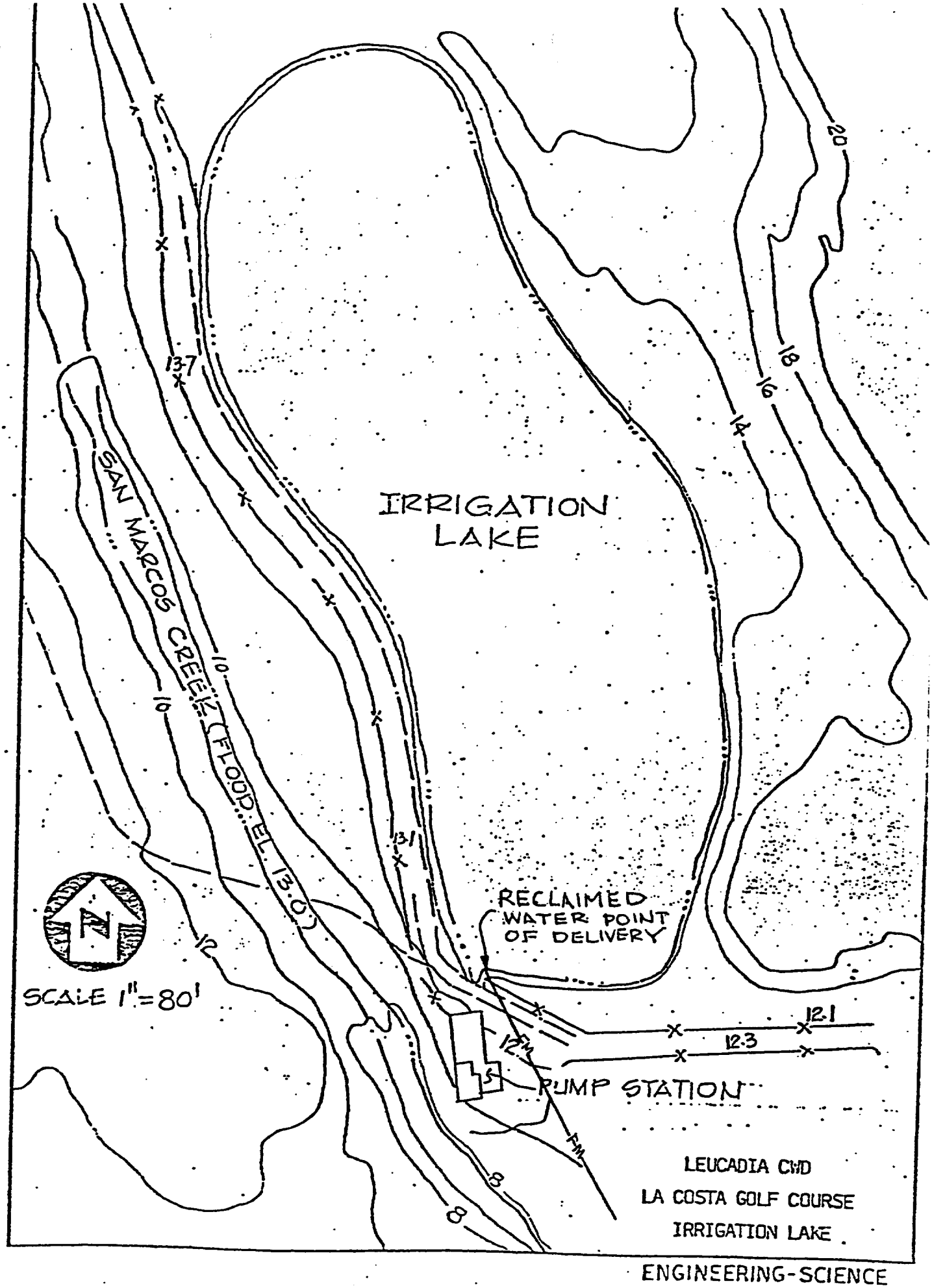

IRRIGATION LAKE
SAN MARCOS CREEK (FLOOD EL. 13.0)
RECLAIMED WATER POINT OF DELIVERY
PUMP STATION
FM
20
18
16
14
13.7
13.1
12.1
12.3
12
10
8
N
SCALE 1"=80'
LEUCADIA CWD
LA COSTA GOLF COURSE
IRRIGATION LAKE
ENGINEERING-SCIENCE

EXHIBIT "C"

ORDINANCE NO. 10

AN ORDINANCE OF LEUCADIA COUNTY WATER DISTRICT PROHIBITING THE DISCHARGE OF WATER SOFTENER REGENERATION BRINES WITHIN A PORTION OF THE DISTRICT

WHEREAS, Leucadia County Water District has in the past and intends in the future to operate a treatment plant for the reclamation of sewage from a portion of the District; and

WHEREAS, the drainage area tributary to the District's Green Valley sewer trunk line is the only portion of the District from which sewage can be collected for reclamation purposes at the present time; and

WHEREAS, the discharge of water softener regeneration brines into the sewage to be reclaimed will make such reclamation unfeasible; Now Therefore,

BE IT ORDAINED by the Board of Directors of Leucadia County Water District as follows:

Section 1. It is hereby determined that regeneration brines discharged to the District's facilities from water softening devices within the sewage drainage area tributary to the District's Green Valley sewer trunk line are not amenable to treatment or reduction by feasible sewage treatment processes.

Section 2. There shall be no discharge to the District's facilities of regeneration brines from water softening devices in residential, industrial, commercial or other

EXHIBIT "D"

establishments within the sewage drainage area tributary to the District's Green Valley sewer trunk line, and all such discharges are hereby prohibited.

Section 3. The Secretary-Manager of the District is authorized and instructed to prepare, revise from time to time, and keep on file a map clearly indicating the boundaries of the area tributary to the District's Green Valley sewer trunk line.

Section 4. Water softening devices that are in operation and are discharging regeneration brines within the area tributary to the District's Green Valley sewer trunk line on the effective date of this ordinance may be operated and continue to discharge regeneration brines for a period of: (a) seven (7) years following the date of installation, or (b) five (5) years following the effective date of this ordinance, whichever is longer. No discharges of regeneration brines from such devices shall be permitted after the foregoing amortization period.

Section 5. This ordinance is adopted pursuant to the County Water District Law (Division 12 of the Water Code), including sections 31105 and 31106 thereof. It shall be a misdemeanor for any person to violate this ordinance.

Section 6. This ordinance shall be in full force and effect forthwith upon adoption.

PASSED AND ADOPTED at a meeting of the Board of Directors of Leucadia County Water District held December 9, 1976, by the following vote:

AYES: Directors Henning, Lash, Van Sickle, Law and Bagg

NOES: None

ABSENT: None

Harold Henning
President

ATTEST:

Secretary

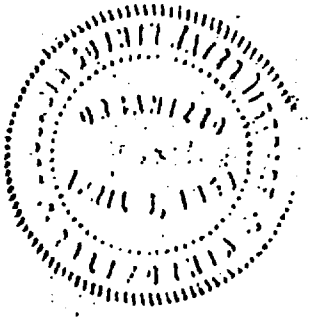


Exhibit 3

AGREEMENT FOR RECYCLED WATER SERVICE BETWEEN THE VALLECITOS WATER DISTRICT AND THE CARLSBAD MUNICIPAL WATER DISTRICT

THIS AGREEMENT for Recycled Water Service, dated as of September 24, 2008 ("Agreement") is made and entered into by and between the VALLECITOS WATER DISTRICT ("VALLECITOS"), a public agency organized and existing pursuant to the County Water District Law, California Water Code Section 30000 et. seq., and the CARLSBAD MUNICIPAL WATER DISTRICT ("CARLSBAD"), a public agency organized under the Municipal Water Act of 1911, and a subsidiary District to the City of CARLSBAD organized and existing pursuant to Water Code Section 71000 et. seq. (collectively, the "Parties").

RECITALS

A. VALLECITOS and CARLSBAD both have the legal authority to provide potable water and recycled water service to customers within their respective service areas.

B. CARLSBAD and VALLECITOS have overlapping recycled water service areas as shown on the attached Exhibit "A", with potable water service being provided by VALLECITOS in the overlapping areas. CARLSBAD has recycled water pipelines within a portion of VALLECITOS that can be used to deliver recycled water for irrigation purposes within the VALLECITOS service area.

C. CARLSBAD has adopted Ordinance No. 43 requiring the use of recycled water within its service area wherever it has determined that its use is economically justified, financially and technically feasible, and consistent with legal requirements, preservation of public health, safety and welfare, and the environment.

D. Through the Agreement to Purchase Reclaimed Water dated August 20, 2003, ("RECLAIMED WATER AGREEMENT") between the Parties, VALLECITOS has agreed to provide up to 3.0 million gallons per day (mgd) of recycled water from the Meadowlark Water Reclamation Facility to CARLSBAD's recycled water system, referred to as the "Encina Basin Water Reclamation Program".

E. By this Agreement, VALLECITOS desires to provide recycled water within its service area including that portion of the VALLECITOS service area within the City of CARLSBAD, and CARLSBAD is willing to provide recycled water to VALLECITOS customers within the VALLECITOS service area at retail rates in accordance with the terms and conditions of this Agreement.

COVENENTS

NOW, THEREFORE, it is agreed by and between the parties as follows:

SECTION 1. Recycled Water Delivery Area. VALLECITOS and CARLSBAD have determined that some VALLECITOS customers, located along Rancho Santa Fe Road in Carlsbad, California can be served recycled water from CARLSBAD's recycled water system, by connection to VALLECITOS' "Recycled Water Transmission Main" located in Rancho Santa Fe Road. VALLECITOS agrees to allow these customers to be served recycled water by CARLSBAD. The recycled water customers shall be limited to that portion of the VALLECITOS service area within the City of Carlsbad, as shown on the attached Exhibit "A".

SECTION 2. Discharge Standards. All recycled water supplied by CARLSBAD to the customers in the VALLECITOS service area shall meet federal, state, and local discharge requirements, which shall include all generally adopted requirements for CARLSBAD as approved by the Regional Water Quality Control Board, San Diego Region.

SECTION 3. Operation and Maintenance of Facilities. CARLSBAD shall be responsible for operating and maintaining its recycled water system, including pipelines, meters, service lines, and corporation valves in a state of repair and condition that will meet the standards referenced in the above Section 2 of this Agreement. These facilities also include pipelines, meters, service lines, and corporation valves connected to VALLECITOS' "Recycled Water Transmission Main" located in Rancho Santa Fe Road as shown on Exhibit "A", and CARLSBAD's recycled water pipelines connected to VALLECITOS' "Recycled Water Transmission Main" intended for local distribution of recycled water by CARLSBAD. The point of connection to VALLECITOS' "Recycled Water Transmission Main", including the branch valve shall be owned and maintained by VALLECITOS with the provision that VALLECITOS shall provide CARLSBAD notice within 24 hours of any adjustment or operation of the branch valve(s) by VALLECITOS, excluding emergencies. In an emergency such as a pipeline break CARLSBAD shall be permitted to close the branch valve(s) to make necessary repairs to its recycled water system. CARLSBAD shall notify VALLECITOS as soon as possible regarding operation of the valve(s). CARLSBAD shall be responsible for any damages caused by their operation of the branch valve(s).

SECTION 4. Recycled Water Customer Requirements. Recycled water service to customers shall meet the requirements of CARLSBAD's Ordinance No. 43, California State Department of Health Services requirements, which requires the need to perform annual walk-through inspections on every site by CARLSBAD and Order No. 2001-352 "Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water", adopted by the California Regional Water Quality Control Board, San Diego Region and amendments thereto. Also, depending on site characteristics there may be either a "no shut-down test" required, an annual "shut-down test" or a "shut down test" performed once every four years. VALLECITOS will cooperate with CARLSBAD to establish a mutual agreeable time to perform the required shutdown tests. The shut-down tests will require shutting off potable water supplies to

7

some potable water customers during the test time period not to exceed 24 hours, except that the test time period for residential customers shall not exceed 12 hours. VALLECITOS shall provide contact information to CARLSBAD of potable water customers impacted by the testing. CARLSBAD shall provide a fourteen day advance notice to recycled water and potable water customers, and to VALLECITOS regarding any shut-down testing to be performed.

SECTION 5. Billing and Rates. It shall be CARLSBAD's responsibility to read the recycled water meters of customers within the service area described herein and to provide the billing for the customers based on CARLSBAD's adopted retail recycled water rates in affect at the time of the billing and to collect the billing from the recycled water customer.

SECTION 6. Term of Agreement. This Agreement shall be effective as of the date first above written, and shall run concurrent with the term of the RECLAIMED WATER AGREEMENT. In the event the RECLAIMED WATER AGREEMENT terminates for any reason, this Agreement shall also terminate with the understanding that CARLSBAD will continue to provide recycled water to the customers identified in Section 1 above until either a new agreement has been entered into between VALLECITOS and CARLSBAD to continue recycled water delivery to these customers by CARLSBAD, or VALLECITOS has made the necessary modifications, and improvements required to supply water to these customers. VALLECITOS agrees to provide written notification to CARLSBAD that it is ready to supply water to the customers beginning on a date to be specified by VALLECITOS. The parties shall cooperate in transferring customers from CARLSBAD to VALLECITOS including coordination of all notices, and transfer of customer accounts. Construction costs incurred by CARLSBAD for new capital improvements, within the service area (Exhibit "A"), required to provide recycled water to VALLECITOS customers from the date of this Agreement shall be reimbursed by VALLECITOS (20 year depreciation) if VALLECITOS terminates the August 20, 2003 Agreement without cause. CARLSBAD shall provide documentation to VALLECITOS on an annual basis of any new capital improvements.

SECTION 7. Miscellaneous Provisions.

7.1 Venue. In the event of any legal or equitable proceeding to enforce or interpret the terms or conditions of this Agreement, the parties agree that venue shall lie only in the Federal or State courts in or nearest to the North County Judicial District, County of San Diego, State of California.

7.2 Modification. This Agreement may not be altered in whole or in part except by a modification, in writing, executed by all the parties to this Agreement.

7.3 Incorporation of Agreement to Purchase Reclaimed Water. A copy of the Agreement to Purchase Reclaimed Water dated August 20, 2003, is attached hereto as Exhibit "B" and incorporated herein by reference.

7.4 Entire Agreement. This Agreement, together with all the exhibits attached to this Agreement, contains all representations and the entire understanding between the parties with respect to the limited subject matter of this Agreement. This Agreement shall not modify or supersede the RECLAIMED WATER AGREEMENT.

"VALLECITOS"

VALLECITOS WATER DISTRICT

By: _____
Timothy M. Shell, President

"CARLSBAD"

CARLSBAD MUNICIPAL WATER DISTRICT

By: _____
Claude "Bud" Lewis, President

ATTEST:

_____
WILLIAM W. RUCKER, Secretary
Board of Directors

ATTEST:

_____
LORRAINE M. WOOD
City Clerk

CITY OF CARLSBAD CALIFORNIA
EUREKA

APPROVED AS TO FORM:

JEFFREY G. SCOTT, Legal Counsel

By: _____

RONALD R. BALL, City Attorney

By: _____
9/18/08.

EXHIBIT "A"

MAP OF CARLSBAD MUNICIPAL WATER DISTRICT'S RECYCLED WATER SERVICE AREA WITHIN VALLECITOS WATER DISTRICT

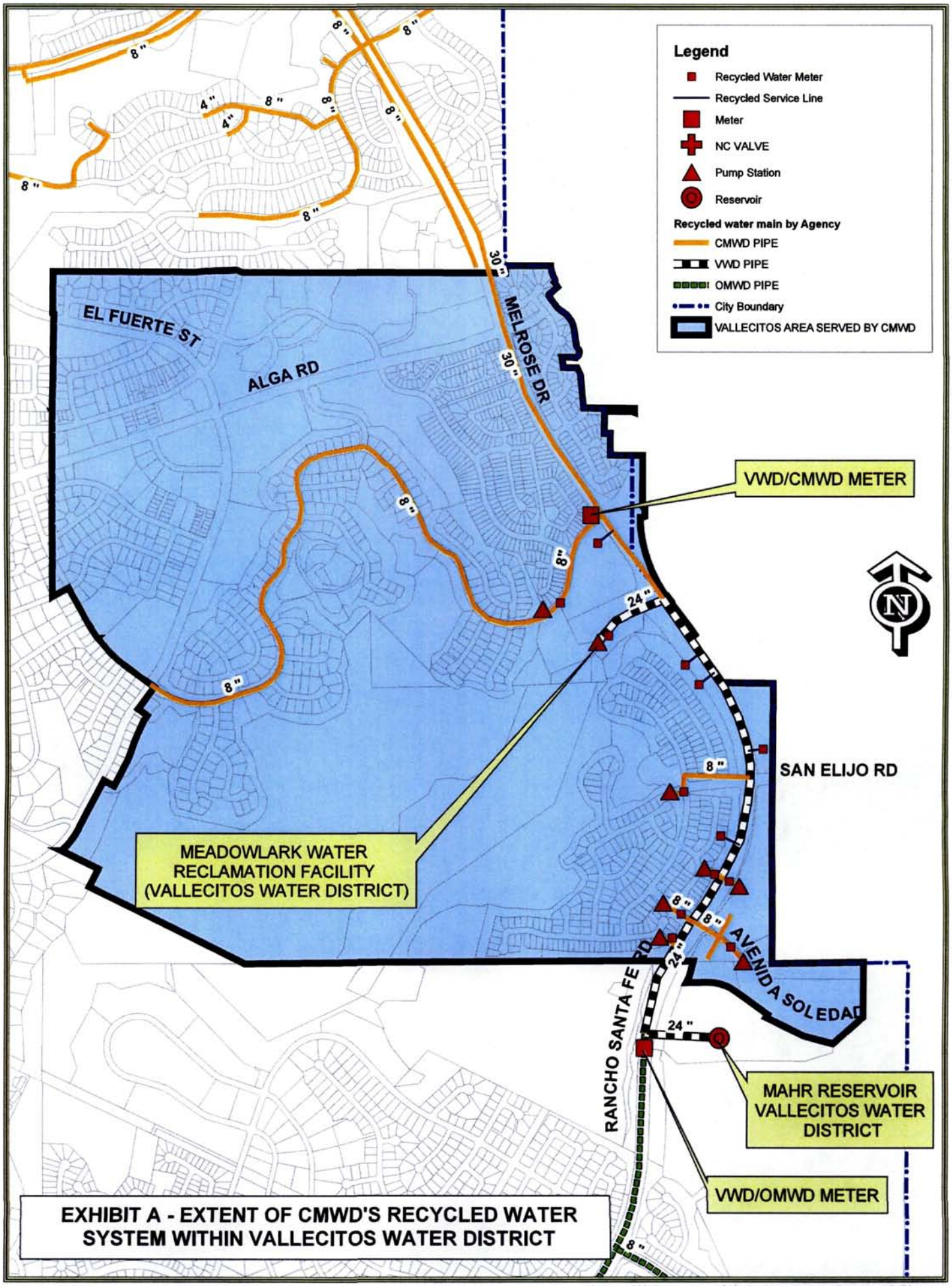


EXHIBIT A - EXTENT OF CMWD'S RECYCLED WATER SYSTEM WITHIN VALLECITOS WATER DISTRICT

DATE: 08/12/2008 NAME: LRosu/Arome FILE: J:\GIS\Engineering\GIS_Projects\ArcviewProjects-LR\Plummer

Exhibit B

AGREEMENT FOR SALE OF RECYCLED WATER AND USE OF MAHR RESERVOIR BETWEEN THE VALLECITOS WATER DISTRICT AND THE CARLSBAD MUNICIPAL WATER DISTRICT

This Agreement is made and entered into by and between the VALLECITOS WATER DISTRICT ("VALLECITOS"), organized and existing pursuant to Water Code section 30000 et seq., and the CARLSBAD MUNICIPAL WATER DISTRICT ("CARLSBAD"), a Public Agency organized under the Municipal Water Act of 1911, and a subsidiary district of the City of Carlsbad organized and existing pursuant to Water Code section 71000 et seq. (collectively, the "Parties").

RECITALS

A. On June 13, 1991, the Parties entered into an agreement (the "1991 Agreement") for the sale of recycled water from the VALLECITOS' Meadowlark Reclamation Facility ("MRF"). Since July 1991, VALLECITOS has provided recycled water to CARLSBAD in accordance with the terms and conditions of the 1991 Agreement.

B. VALLECITOS is currently in the process of evaluating an expansion of the MRF and the increase in production from two (2) million gallons per day ("MGD") of recycled water to a potential of five (5) MGD.

C. VALLECITOS also owns, operates, and maintains the Mahr Reservoir, which has the capacity to store fifty-four (54) million gallons ("MG") of recycled water and is located within the boundaries of both VALLECITOS and the City of Carlsbad.

D. CARLSBAD is in the process of developing an expansion of its recycled water system referred to as the Encina Basin Water Reclamation Program, Phase II Project ("Phase

II Project"). CARLSBAD desires to use the Mahr Reservoir for seasonal, operational (diurnal), and emergency storage as part of the Phase II Project. The scheduled dates for implementation of the Phase II Project is July 2005.

E. VALLECITOS agrees to allow CARLSBAD to use a portion of the storage capacity of Mahr Reservoir, provided CARLSBAD constructs certain improvements to the Mahr Reservoir. The storage capacity available to CARLSBAD in the Mahr Reservoir shall be up to 32 MG, provided CARLSBAD purchases from VALLECITOS an additional one (1) MGD of recycled water (for a total of 3 MGD) as part of the Phase II Project.

F. CARLSBAD acknowledges that delivery of the recycled water volume outlined in this Agreement is contingent upon the expansion of the MRF by VALLECITOS and sufficient development within VALLECITOS and build out of the Meadowlark area and drainage basin to provide enough effluent to produce the recycled water.

NOW, THEREFORE, the Parties agree to the following terms and conditions:

1. Construction of Mahr Reservoir Improvements. CARLSBAD shall be responsible for constructing and installing certain improvements (the "Improvements") that include, but may not be limited to, the draining and cleaning of the interior storage area of the Mahr Reservoir, installing a chlorination system and aeration system, modifying the inlet/outlet works, and installing an asphalt concrete liner and floating polypropylene cover as further described in the Encina Basin Recycled Water Distribution Study prepared by CGvL Engineers in association with John Powell & Associates, Inc., dated May 2000 (the "Study"). A copy of the Study is attached to this Agreement as Exhibit "A" and incorporated herein by reference. VALLECITOS has reviewed the Study and consents to the recommended Improvements and other pertinent improvements. CARLSBAD shall provide VALLECITOS with sixty (60) days written notice prior to beginning construction of the

improvements. Construction of the Improvements shall be subject to coordination with VALLECITOS staff. The schedule to construct the Improvements is based on CARLSBAD receiving a commitment for funding from the State of California in 2003, whereby construction would begin in 2003 and extend through 2004.

2. Funding and Design of Improvements. CARLSBAD shall construct the Improvements with funding obtained from state and federal loans and grants. CARLSBAD shall be responsible for the design and preparation of the plans and specifications for the Improvements and will obtain any necessary permits on behalf of VALLECITOS and with the written consent of VALLECITOS, which consent shall not be unreasonably withheld. All plans and specifications for the Improvements shall be submitted to VALLECITOS for review and approval, which approval shall not be unreasonably withheld. CARLSBAD shall construct the Improvements in accordance with the approved plans and specifications and permit conditions including compliance with CEQA and all other regulatory bodies. The Improvements shall become the property of VALLECITOS and shall be dedicated to VALLECITOS for operation and maintenance. If funding for the Improvements is not approved by the State of California, then CARLSBAD is not obligated to design or construct the Improvements. In the event the Improvements are not constructed, for whatever reason, all rights of CARLSBAD to purchase recycled water beyond 2 MGD and to utilize storage in the Mahr Reservoir shall terminate in the discretion of VALLECITOS.

3. Mahr Reservoir Storage Capacity. CARLSBAD shall have the right to utilize up to 32 MG of storage capacity available in the Mahr Reservoir for its Phase II Project. In the event CARLSBAD discontinues the purchase of recycled water from VALLECITOS, the use of storage capacity of the Mahr Reservoir shall automatically revert to VALLECITOS. CARLSBAD shall be allowed to utilize Mahr Reservoir for peak demands in accordance with the approved Operations and Maintenance manual referenced in Section 5. In no event shall CARLSBAD have any priority in Hydraulic Grade Line (HGL) or

available capacity of the reservoir and shall be entitled to up to a maximum of 60% of the storage available at any given time.

4. Master Flow Meters. Master recycled water flow meters ("Master Flow Meter(s)") shall be installed by CARLSBAD at or near the MRF, in locations mutually agreeable to the Parties, to measure the quantity of recycled water supplied to CARLSBAD from the MRF. VALLECITOS shall be responsible for operating, maintaining, calibrating, and reading the Master Flow Meter(s) on a routine basis. VALLECITOS shall read and report to CARLSBAD the meter results no less than once per month and shall provide copies to CARLSBAD of calibration results on an annual basis. VALLECITOS shall deliver recycled water to CARLSBAD to the mutually agreed upon locations of the Master Flow Meter(s) and shall have no responsibility or obligation to deliver recycled water beyond the Master Flow Meter location(s).

5. Ownership, Operation, and Maintenance of Mahr Reservoir Improvements. VALLECITOS shall own, operate, and maintain the Mahr Reservoir and all Improvements constructed for the Mahr Reservoir. A draft operation and maintenance manual shall be prepared by CARLSBAD for review, and approval by VALLECITOS, for operation and maintenance of the Improvements, which will be incorporated in an operations and maintenance manual for the operation of MRF, Mahr and the Failsafe pipeline. VALLECITOS shall operate the Improvements in conformance with the approved operations and maintenance manual. Notwithstanding the foregoing, in no case shall VALLECITOS be required to operate the Improvements in a fashion that will be harmful or detrimental to the operation of the MRF, Mahr Reservoir, or the Fail Safe pipeline.

6. Operation and Maintenance of Other Related Facilities. VALLECITOS shall own, operate, and maintain, per the approved operations and maintenance manual, the

recycled water transmission pipeline identified on the attached Exhibit "B," which is incorporated herein by reference.

Each party shall grant to the other necessary easements and rights-of-way to construct, operate and maintain the recycled water facilities described in this Agreement that they respectively control and assist each other to obtain easements or rights-of-way on lands controlled by other entities not subject to this Agreement.

7. Failsafe Pipeline Capacity and Operation. CARLSBAD acknowledges and agrees that under certain operational scenarios, the full production of MRF may exceed the failsafe pipeline capacity of 3 MGD and to accommodate operational goals, the Mahr Reservoir may be at capacity with no additional, available storage. To accommodate such an event, CARLSBAD agrees, per the approved operations and maintenance manual, to provide adequate facilities and operational flexibility to VALLECITOS to dispose of the additional flow into the CARLSBAD recycled water distribution system for either use or disposal. Disposal of recycled water through the CARLSBAD system is subject to and predicated upon the availability of adequate capacity at the Encina Wastewater Authority (EWA) flow equalization facility and coordination with EWA. All excess recycled water, beyond purchases required in Section 8 and peak demands, shall meet the quality requirements contained in Section 10. The method of disposing shall be identified in the operational parameters agreed upon between the Parties.

CARLSBAD agrees to completely remove the existing Phase I Pump Station, located at El Camino Real, prior to or concurrent with the initial delivery of 3 mgd of recycled water in accordance with Section 8. CARLSBAD agrees to replace the existing 12-inch Failsafe pipeline with like pipeline material in accordance with VALLECITOS standards.

8. Quantities of Recycled Water to be Purchased. During the term of this Agreement, CARLSBAD agrees to purchase, and VALLECITOS agrees to deliver to the CARLSBAD recycled water distribution system (provided flows are sufficient), the following minimum amounts of recycled water from the MRF:

a. Prior to completion of the Phase II Project, CARLSBAD shall continue to purchase a minimum of 2 MGD of recycled water which is approximately 2,240 acre-feet per year.

b. Upon completion of the Phase II Project, and provided VALLECITOS has completed the expansion of the MRF and adequate effluent is available, CARLSBAD agrees to purchase a minimum of 2 MGD of recycled water during the months of December, January, February, and March and 3 MGD of recycled water for the remaining months which is approximately 2,989 acre-feet per year.

9. Interruption of Delivery of Recycled Water. Notwithstanding the provisions of section 8 above, the Parties understand and agree that there shall be no liability to VALLECITOS to supply recycled water, or obligation of Carlsbad to purchase recycled water for day-to-day interruptions in delivery of recycled water due to plant emergencies requiring plant shut down and repairs associated with acts of God, permit compliance, orders by regulatory bodies or judicial courts, and/or equipment breakdowns, or substantial maintenance activities. VALLECITOS shall make good faith efforts to resume delivery of recycled water in a timely manner after completing the necessary efforts to restore the operation of MRF. If recycled water delivery is discontinued for more than seven (7) consecutive days, then VALLECITOS shall provide CARLSBAD a time schedule indicating when delivery is expected to resume.

10. Treatment Standards. VALLECITOS shall treat the recycled water from the MRF in conformance with the water quality requirements as provided by Title 22, Division 4, of the California Code of Regulations ("CCR"), section 60305, "Use of Recycled Water for Impoundments," intended as a source of supply for non-restricted recreational impoundments suitable for body contact in compliance with the criteria specified in CCR section 60301.230(b) for "Disinfected Tertiary Recycled Water" (Title 22). VALLECITOS shall use its best good faith efforts to ensure that said recycled water meets the forgoing CCR Title 22 standards, however, VALLECITOS does not guarantee or warrant the quality of the recycled water provided CARLSBAD or subsequent users. Both Parties understand that the presence of dissolved minerals in the recycled water is measured as total dissolved solids (TDS) and other substances in higher concentrations can be deleterious to the plants irrigated with such water. Both Parties agree that VALLECITOS' failure to supply recycled water with TDS concentration of less than 1000 milligrams per liter (MG/L), as determined in conformance with the methodology specified in the Encina Waste Pollution Control Facility Waste Discharge Permit, will be grounds for CARLSBAD to suspend its obligation to accept and pay for recycled water from VALLECITOS until quality is restored to less than 1000 MG/L TDS.

VALLECITOS agrees to limit the total chlorine residual to 10 parts per million (ppm) or less, based upon a 24 hour period average, for recycled water discharged from the MRF. This limitation shall not be applicable to water discharged to the VALLECITOS Failsafe pipeline.

The Parties further recognize that during periods of drought VALLECITOS may experience lower flow as a result of conservation efforts. However, the amounts of salts received would not decrease and can cause the TDS levels to rise. During such drought periods as designated by the Metropolitan Water District ("MWD") and/or the San Diego County Water Authority ("Water Authority"), the Parties agree that recycled water with TDS

concentration of no more than 1200 MG/L will be an acceptable quality to CARLSBAD under the terms of this Agreement.

11. Recycled Water Delivery Pressure. Recycled water delivered by VALLECITOS to the CARLSBAD distribution system shall not be at a guaranteed minimum pressure. However, the following hydraulic grade line ("HGL") shall be met for recycled water discharges from the MRF to the Mahr Reservoir facility. Discharge pressure for delivery at the Mahr Reservoir shall be equivalent to a minimum HGL of 550 feet, including all pipeline headloss, with an operational HGL goal of 590 feet to maximize operational flexibility.

12. Compliance With Regulatory Requirements. CARLSBAD agrees to comply with all applicable recycled water distribution regulations issued and/or mandated by the State of California Department of Health Services (DHS), the County of San Diego Department of Environmental Health (DEH), and the California Regional Water Quality Control Board, San Diego Region (Regional Board). CARLSBAD shall be responsible for insuring that all users of recycled water within CARLSBAD's jurisdiction shall be in compliance with CARLSBAD's discharge order issued by the Regional Board, and that all users shall be made to comply with CARLSBAD's most recent recycled water rules and regulations.

13. Price of Recycled Water. Through Fiscal Year 2003/2004, CARLSBAD shall purchase, disinfected tertiary recycled water from VALLECITOS at the rate of Three Hundred Sixty-One Dollars ($361.00) per acre-foot, and CARLSBAD shall pay VALLECITOS for the recycled water based on quarterly statements submitted by VALLECITOS. Beginning Fiscal Year 2004/2005 the purchase cost shall be based on the table for Pre-Expansion Annual Cost for the MRF Tertiary Facilities listed in Exhibit "C". Upon completion of the MRF expansion, and initial delivery of 3 MGD to CARLSBAD,

CARLSBAD shall purchase, in accordance with section 8(b), disinfected tertiary recycled water from VALLECITOS using the table for Post-Expansion Annual Cost for MRF Tertiary Facilities listed in Exhibit "C." CARLSBAD shall pay VALLECITOS the annual cost in twelve (12) equal payments throughout each fiscal year. Both the Pre-Expansion and the Post-Expansion Annual Costs shall be based on VALLECITOS' budgeted figures as of the beginning of each fiscal year and adjusted to actual costs through retrospective adjustments after the conclusion of each fiscal year. The recycled water cost shall be adjusted on July 1 of each year during the term of this Agreement to reflect CARLSBAD'S proportionate share of the budgeted operational, overhead, and capital recovery costs for the MRF Tertiary Facilities, Lift Station No. 1, and Mahr Reservoir as shown in Exhibit "C". VALLECITOS will provide CARLSBAD thirty (30) days' advance written notice of any changes in the annual cost. VALLECITOS will bill or credit CARLSBAD annually for retrospective adjustments to reflect actual water delivery costs incurred. CARLSBAD will be notified of the retrospective adjustment by November 30 of each fiscal year and the adjustment credit/invoice shall be due and payable within 30 days of said date. At any time during the term of this agreement, the price of the recycled water shall not exceed seventy-five percent (75%) of CARLSBAD'S wholesale cost of potable water from the San Diego County Water Authority.

The definitions for terms used in this section 13 and Exhibit "C" follow:

MRF Facilities – Wastewater treatment, filtration, disinfection, conveyance, storage and effluent pumping facilities shown on Exhibit "B". Also known as Meadowlark Reclamation Facility (MRF).

MRF Tertiary Facilities – Filtration, disinfection, and effluent pumping facilities relating to Tertiary Treatment at the MRF.

Mahr Reservoir – A 54 million-gallon earthen reservoir used to store tertiary treated recycled water located as shown on Exhibit "B".

Lift Station No. 1 – Components associated with the existing lift station used to divert sewage to the MRF for treatment and production of recycled water.

Overhead – Wastewater Department Overhead – General, administrative and overhead costs incurred within the Wastewater Department not directly associated with the collection, conveyance and treatment of wastewater.

Pre-Expansion Cost – This includes all costs associated with the operation and maintenance of the MRF Tertiary Facilities, Lift Station No. 1, Mahr Reservoir and identified capital recovery costs, shown in Exhibit "C" under the title "Pre-Expansion Annual Cost."

Post-Expansion Cost – This includes all costs associated with the operation and maintenance of the MRF Tertiary Facilities, Lift Station No. 1, Mahr Reservoir and capital recovery costs shown in Exhibit "C" under the title "Post-Expansion Annual Cost." These costs will apply after VALLECITOS has begun the initial delivery of 3 mgd to CARLSBAD.

14. Terms of Payment. CARLSBAD shall be invoiced by VALLECITOS on a monthly basis for the minimum delivery scheduled amounts plus any amounts that exceed the minimum amounts. CARLSBAD agrees to pay VALLECITOS for such purchases within thirty (30) days of invoice receipt. In the event that payment is more than thirty (30) days in arrears, VALLECITOS reserves the right to stop delivery of recycled water until payment is made and charge interest of one percent (1%) per month on delinquent amounts.

15. Right to Sell to Others/Utilization of Storage. In the event CARLSBAD fails to purchase the minimum quantities of recycled water as required in section 8 of this Agreement, VALLECITOS shall have the absolute right and discretion to sell the unused recycled water to other parties. Any amounts sold by VALLECITOS to other parties shall be deducted from any remaining amounts that CARLSBAD is obligated to purchase pursuant to section 8 of this Agreement. In addition, in the event CARLSBAD fails to purchase the minimum quantities of recycled water as required in section 8 of this Agreement, all rights of CARLSBAD to utilize storage in the Mahr Reservoir shall revert to VALLECITOS and VALLECITOS shall have no obligation or liability to reimburse CARLSBAD for the cost of the Improvements. Provided, however, in the event VALLECITOS willfully refuses to provide recycled water to CARLSBAD, when available, prior to complete depreciation of the Improvements identified in section 1 "Construction of Improvements," VALLECITOS shall reimburse CARLSBAD for the lesser of the fair market value or the undepreciated value of the Improvements. In the event VALLECITOS uses or sells recycled water to additional parties, VALLECITOS will reimburse or credit CARLSBAD with up to forty percent (40%)of the cost of the improvements, based upon a ratio of water sold to CARLSBAD and total sales, of the annual depreciated value of the Improvements identified in Section 1 based upon a thirty (30) year useful life. The reimbursement or credit shall be in accordance with the annual review of the price of the recycled water in accordance with Section 13.

16. Access to Records. The Parties shall each keep proper books and records in which complete and correct entries shall be made of all recycled water delivered to CARLSBAD throughout the duration of this Agreement. These books and records shall, upon written request, be subject to inspection by any duly authorized representative of each party and of the Regional Board.

17. Notices. Notices required or permitted under this Agreement shall be given in writing and may either be served personally upon the party to whom it is directed or by deposit in the United States Mail, postage pre-paid, certified, return receipt requested, addressed to the Parties' following addresses:

CARLSBAD: Carlsbad Municipal Water District
1635 Faraday Avenue
Carlsbad, CA 92008
Attention: Public Works Director

VALLECITOS: Vallecitos Water District,
201 Vallecitos de Oro
San Marcos, CA 92069
Attention: General Manager

18. Assignment. This Agreement or any interest therein or any monies due or that are to become due thereunder shall not be assigned, hypothecated, or otherwise disposed of without the prior written consent of both Parties to this Agreement, which consent shall not be unreasonably withheld. This Agreement shall become effective on the date it is executed by the Parties.

19. Term of Agreement. The term of this Agreement shall be twenty-two (22) years from the effective date, subject to the rights of the Parties to an earlier termination as provided in this Agreement. This Agreement shall continue in force from year to year after the initial 22-year term until either party gives one (1) year's written notice to the other of its intention to terminate or renegotiate the Agreement. This Agreement shall terminate one (1) year from the date upon which such written notice is received unless the Parties agree otherwise in writing.

20. Early Termination. If at any time during the term of this Agreement recycled water in compliance with the standards referenced herein cannot lawfully be used by CARLSBAD for the purposes intended by this Agreement, because of government

regulations now in effect or hereinafter imposed, or, if CARLSBAD should for any reason breach its obligations under this Agreement in any material respect, including, but not limited to, failure to pay for recycled water as required, failure to accept recycled water as required, failure to maintain facilities, or other substantial failure, VALLECITOS may terminate this Agreement with no further obligation by giving sixty (60) days' written notice thereof to CARLSBAD. During said sixty (60) day period, CARLSBAD shall have the opportunity to cure the breach in the Agreement before termination occurs. In the event VALLECITOS refuses to deliver recycled water to CARLSBAD in conformance with this Agreement for any reason, CARLSBAD may terminate this AGREEMENT with no further obligation upon sixty (60) days' written notice thereof to VALLECITOS.

21. Entire Agreement. This Agreement constitutes the entire understanding between the Parties with respect to the subject matter hereof superseding all negotiations, prior discussions, agreements, and understandings, written or oral, including the 1991 agreement. This Agreement shall not be amended, except by written consent of the Parties, and no waiver of any rights under this Agreement shall be binding unless it is in writing signed by the party waiving such rights. In the event any provision of this Agreement shall be held to be invalid and unenforceable, the other provisions of this Agreement shall be held to be valid and binding on the Parties.

22. Binding Effect. This Agreement shall be binding upon the Parties and their respective successors in interest, permitted assigns, executors, administrators, and personal representatives.

23. Indemnification. VALLECITOS agrees, to the fullest extent permitted by law, to indemnify and hold CARLSBAD, its directors, officers, employees, or authorized volunteers harmless from any damage, liability, or cost (including attorney's fees and costs of defense) to the extent caused by VALLECITOS' negligent acts, errors, or omissions in

the performance of work pursuant to this Agreement, including such negligent acts, errors, or omissions by subcontractors or others for whom VALLECITOS is legally liable. CARLSBAD agrees, to the fullest extent permitted by law, to indemnify and hold VALLECITOS, its directors, officers, employees, or authorized volunteers harmless from any damage, liability, or cost (including attorney's fees and costs of defense) to the extent caused by CARLSBAD's negligent acts, errors, or omissions in the performance of work pursuant to this Agreement including such negligent acts, errors, or omissions by subcontractors or others for whom CARLSBAD is legally liable.

24. Venue. In the event of any legal or equitable proceeding to enforce or interpret the terms or conditions of this Agreement, the Parties agree that venue shall lie only in the courts in or nearest to the North County Judicial District, County of San Diego, State of California.

25. Counterparts. This Agreement may be executed in any number of counterparts, each of which shall be deemed an original, but all of which, taken together, shall constitute one and the same instrument.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed and effective as of August 20, 2003.

"VALLECITOS":

VALLECITOS WATER DISTRICT

By: Trish Hannan
Trish Hannan
President

"CARLSBAD":

CARLSBAD MUNICIPAL WATER DISTRICT

By: Claude Bud Lewis
Claude "Bud" Lewis
President

ATTEST:

General Manager

Date: 8/20/03

ATTEST:

Board Secretary

Date: August 10, 2003

APPROVED AS TO FORM:

Jeffrey G. Scott, General Counsel

Julia Coleman
Ronald R. Ball, General Counsel
BY: DEPUTY CITY ATTORNEY

Carlsbad Municipal Water District

Preliminary Design for the
Encina Basin Phase II Recycled Water Distribution System

MAHR RESERVOIR EVALUATION

CATHCART GARCIA VON LANGEN
CGVL ENGINEERS

in Association with

POWELL
John Powell & Associates, Inc.
Consulting Civil Engineers

May 2000

Exhibit "A"

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Chapter 1 Background

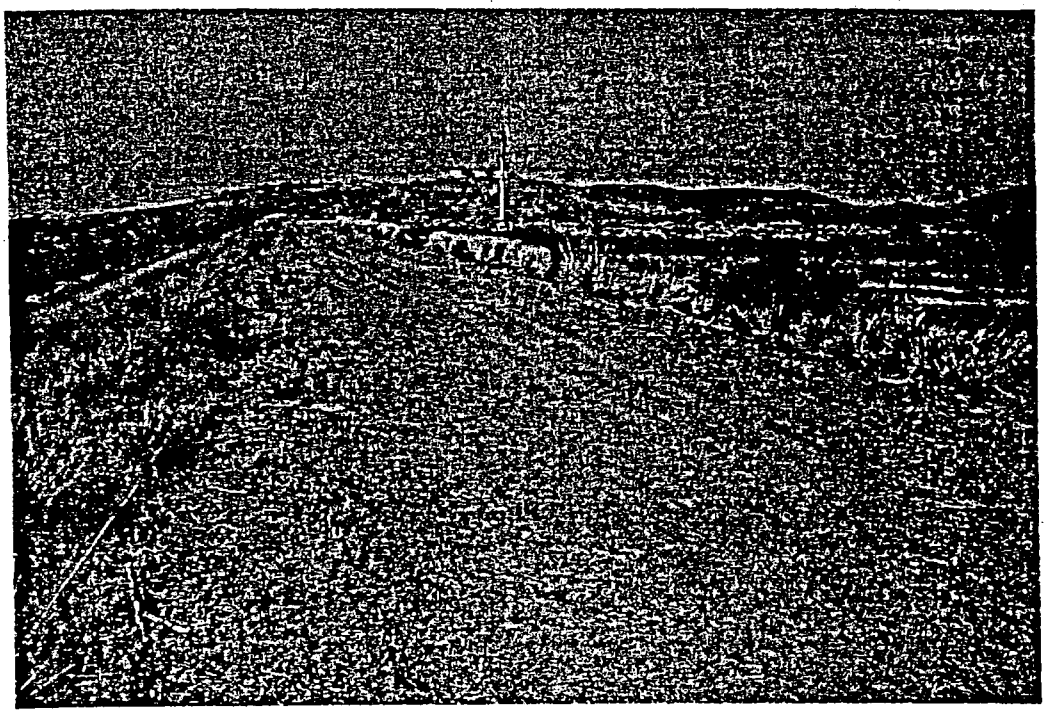
Carlsbad Municipal Water District (CMWD) desires to evaluate the feasibility of using Mahr Reservoir for seasonal storage in CMWD's recycled water distribution system. This evaluation's purpose is to investigate mitigation for historical reservoir operational problems, analyze the effect of this storage volume at various system expansion milestones, evaluate specific reservoir improvements and determine the best combination to pursue, provide an opinion of probable cost, and recommend a course of action for implementation.

Mahr Reservoir Physical Properties

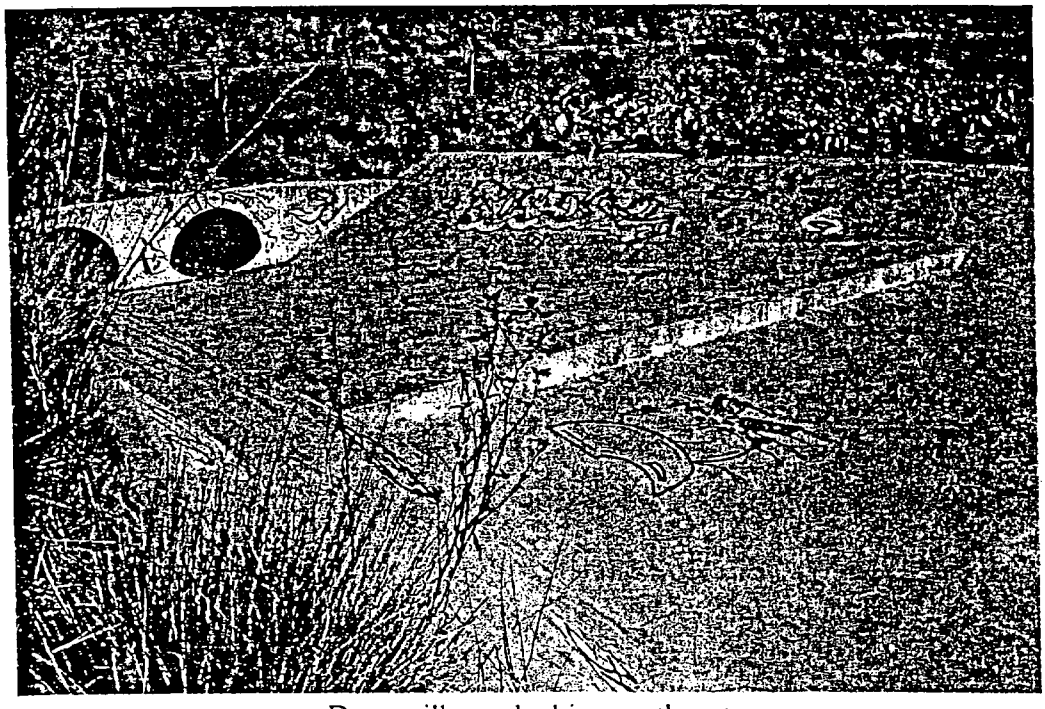
Mahr Reservoir is owned and operated by Vallecitos Water District (VWD). The reservoir is an unlined and uncovered basin formed by a jurisdictional earthen dam, with a crest elevation of approximately 598.5 feet. The reservoir bottom was originally established at approximately 542.5 feet and the spillway elevation is at approximately 594.5 feet. Possibly to allow for storm retention, the maximum operating pool was set in the original facility design at approximately 593.0 feet. For this evaluation, to allow for continued submergence of a possible aeration/destratification system, and to avoid water quality problems associated with shallow storage volumes, a minimum operating pool was set at approximately 555.0 feet, which would maintain a minimum water depth of approximately 12.5 feet.

The effective working storage volume associated with the difference between the maximum and minimum pools is approximately 151 acre-feet (AF), or approximately 49 million gallons (MG). The water surface area at maximum pool depth is approximately 7.7 acres. Figure 1-1 provides recent photos of the reservoir dam crest and spillway. Figure 1-2 provides reservoir volume and area curves in relation to water depth, expressed as feet of elevation above mean sea level (amsl).

Inflow and outflow occur through a concrete structure located near the reservoir bottom at the upstream dam toe. This structure has grated, unvalved ports, and is serviced by an 18-inch diameter pipeline that passes underneath the dam and connects with another concrete structure at the downstream dam toe.

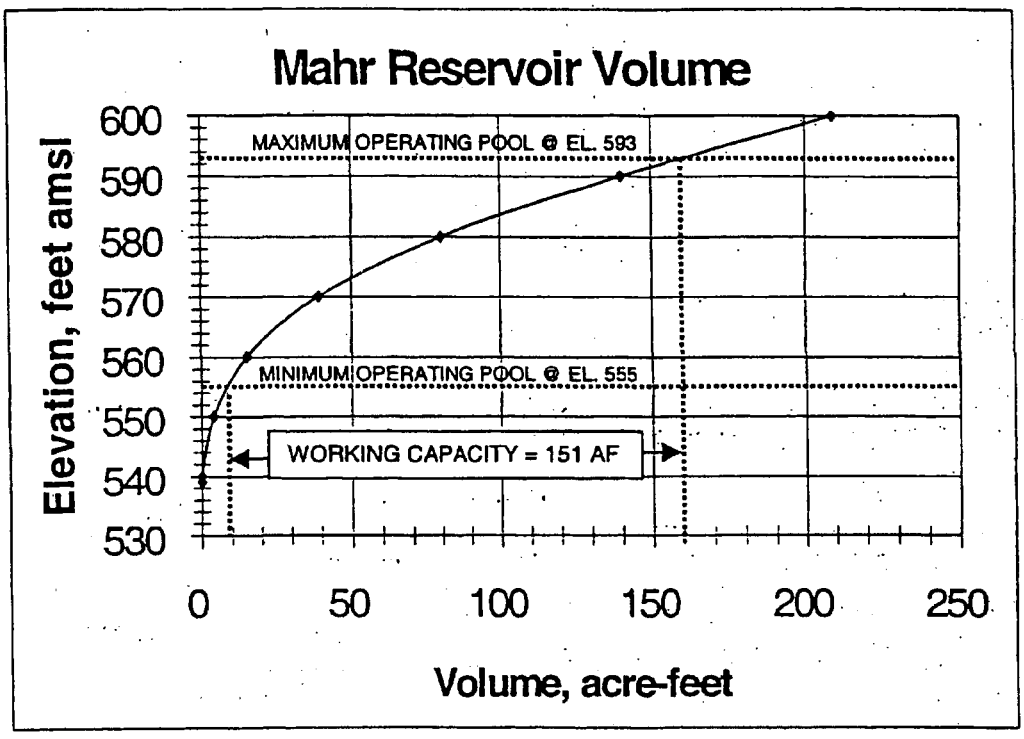


Dam crest, looking north.



Dam spillway, looking northeast.

Figure 1-1 Mahr Reservoir Features



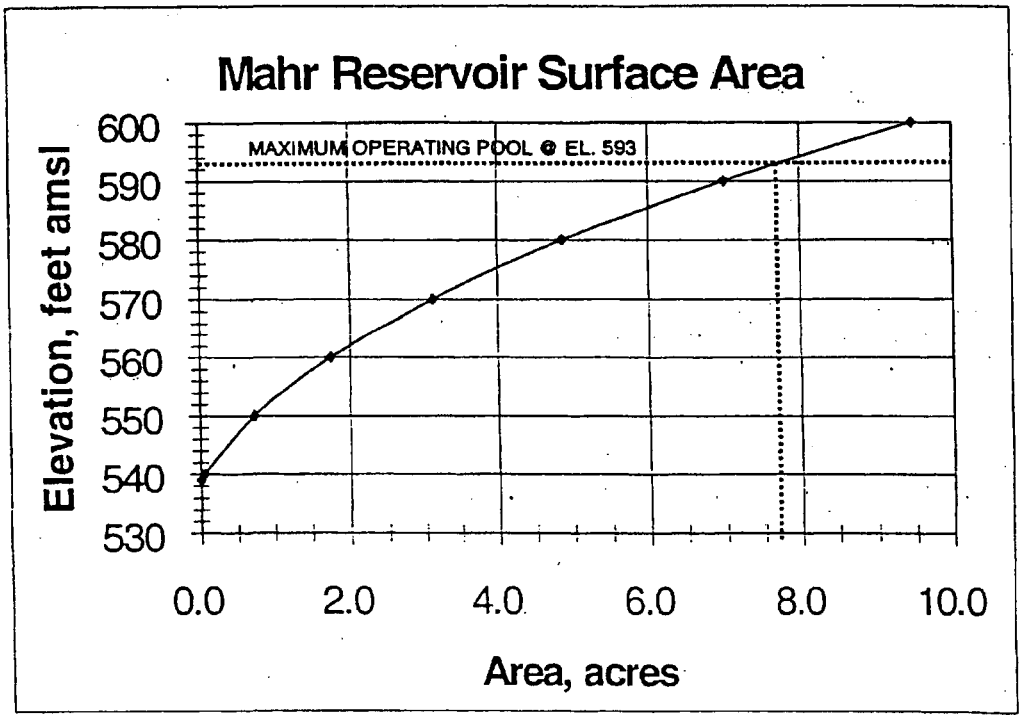


Figure 1-2 Mahr Reservoir Volume and Surface Area Curves

32

Mahr Reservoir Operational Issues

Ongoing water quality problems experienced by VWD prompted installation of fine screens and implementation of associated procedures at their Meadowlark Water Reclamation Facility (WRF) for treatment of all water withdrawn from the reservoir. Historically, during normal operation, effluent from the WRF was pumped to Mahr Reservoir. Outflow from Mahr Reservoir flowed by gravity through a 20-micron microscreen to remove algae before it was pumped again into the recycled water distribution system. Microscreen effluent could then either flow through a chlorine contact tank or directly into the recycled water distribution system pumping station wet well. However, because of continued odor and algae complaints by recycled water customers, with Mahr Reservoir as the suspected source, the reservoir was taken out of service in 1998. Since that time there have been no further complaints regarding odors and algae.

Other Seasonal Storage Reservoirs

As a basis for comparison, this evaluation reviewed design features and operating histories of other recycled water seasonal storage reservoirs with volumes approximately equal to or greater than Mahr Reservoir's. However, relatively few such seasonal storage reservoirs exist. Three of them are located in Orange County. Sand Canyon and Rattlesnake Reservoirs are owned and operated by Irvine Ranch Water District (IRWD), and have total volumes of 800 AF and 1,200 AF, respectively. Upper Oso Reservoir is owned and operated by Santa Margarita Water District (SMWD), and has a total volume of 4,000 AF. All three reservoirs have been in recycled water service for over 20 years.

The City of Santa Rosa, located in northern California, owns and operates several recycled water storage reservoirs. The largest has a volume of 2,000 AF and has been in service for approximately 16 years. Their next two largest reservoirs have volumes of 1,100 AF and 700 AF, respectively, and have been in service for approximately 22 years. All three reservoirs have relatively flat bottoms, with an average water depth, when full, of 24 to 25 feet. All three reservoirs are surrounded by man-made berms, with virtually no tributary drainage area. For this evaluation, these three reservoirs are designated Santa Rosa A, Santa Rosa B, and Santa Rosa C, respectively.

In discussing design and operation of these reservoirs with respective agency staff, several features emerge for possible application at Mahr Reservoir:

- Relative size and watershed management of upstream tributary area
- Average water depth of full reservoir
- Combination of treated wastewater with other water supplies
- Nutrient removal from treated wastewater
- Use of multiple-port inlet/outlet (I/O) works

- Use of an aeration/destratification system
- Chlorination of reservoir outflow
- Other treatment of reservoir outflow
- Use of basin lining and covering

Table 1-1 presents a matrix of these features, listed in the same order, and their involvement at the six above-noted, existing seasonal storage reservoirs. One of the most significant features to emerge in this evaluation appears to be the relative size and watershed management of upstream tributary area. By far the most problematic in this regard of the three reservoirs that have significant tributary area is Sand Canyon Reservoir. Runoff from a large upstream tributary area carries in fine, colloidal material and algal nutrients, difficult to treat in reservoir outflow. Upper Oso Reservoir appears least problematic in this regard of the three. The ratio of tributary area to total reservoir volume for Sand Canyon Reservoir is approximately ten times larger than Upper Oso Reservoir's ratio. Mahr Reservoir, like the three Santa Rosa reservoirs, has almost no upstream tributary watershed area.

Table 1-1 Other Seasonal Storage Reservoir Features

Feature	Sand Canyon	Rattle-snake	Upper Oso	Santa Rosa A	Santa Rosa B	Santa Rosa C
Tributary watershed area	Large	Small	Small	None	None	None
Average water depth	15[a] ft	15[a] ft	30 ft	25 ft	24 ft	24 ft
Combined with other supplies	No	Yes	No	No	No	No
Nutrient removal at plants	Minor[b]	Minor[b]	No	Minor[c]	Minor[c]	Minor[c]
Multiple port I/O works	Yes	Yes	Yes	Yes	No[d]	No[d]
Aeration/Destratification	Yes[e]	No[f]	Yes	No	No	No
Chlorination of outflow	Yes[g]	Yes[g]	No	No	No	No
Other treatment of outflow	Yes[h]	No[i]	No[i]	No	No	No
Basin lining and covering	No	No	No	No	No	No
General problem history	Yes	No	No	No	No	No

a) Estimated.
b) Partial nitrification/denitrification practiced at IRWD's Michelson Water Reclamation Plant, but not primarily for reservoir water quality.
c) Partial nitrification/denitrification practiced at Santa Rosa reclamation plant for last few years, but primarily motivated by regulatory requirement for winter river discharge.
d) Have some turbidity problems with single port and seasonally low water levels.
e) System installed in 1999 with successful performance.
f) Water quality tends to be good without aeration, but installation will be evaluated in 2000.
g) Initially practiced for chemical oxidation of sulfides; later continued partially to maintain a chlorine residual in the associated distribution system.
h) Have tried several types of relatively expensive filtration systems, with varied success.
i) Have only occasionally used Adams strainers.

34

The other significant feature to emerge in this evaluation appears to be the average water depth of a reservoir when full. Santa Rosa staff reported no significant algae growth or other depth-related water quality problems when water depths were predominantly greater than about 8 feet. This meant their three largest reservoirs only suffered problems on the occasions when they were drained to within a few feet of their bottoms. Their two smaller reservoirs (not noted above), with volumes of approximately 200 to 300 AF, have average depths of about 4 feet and have been regularly plagued with algae and related water quality problems. The City has employed algae harvesters and barrel filters to mitigate these problems, with moderate success after considerable effort. Mahr Reservoir's average water depth when full is about 25 feet, and the planned minimal pool depth is 12.5 feet.

Application of the above considerations is explicitly made to Mahr Reservoir in Chapter 4.

Chapter 2
Basis of Evaluation

Design criteria and basic cost data presented herein apply to concept and preliminary level design and layout of recycled water system components. Detailed drawings and specifications are not required in such layouts. For this level, a close approximation of size, location, and cost of various facilities is developed. As a result, some relocation and resizing of facilities may be required at a later date as more detailed engineering analyses are made during final design.

Facility sizing is based on future recycled water requirements listed and developed in Chapter 3. Criteria and standards governing design of proposed facilities are assumed to use quality design, materials, and construction. Further, it is assumed that proper attention will be given to considerations such as appearance, landscaping, operation and maintenance efficiency, and service reliability. In planning future facility needs, an effort has also been made to effectively use existing components where practical.

Proposed facilities described in this evaluation are planned as component parts of a system to serve the projected recycled water requirements of CMWD's proposed Phase II expansion to a system demand of approximately 5,400 acre-feet per year (AFY). Some attention is also given to those improvements required for ultimate expansion to a system demand of approximately 9,800 AFY.

Facility Sizing Criteria

Demand Criteria. Monthly demands are used to determine seasonal supply and storage needs for the recycled water system. The ratio of peak-month to average-month demand, or peak-month factor, is ultimately used in determining pumping and operational storage capacities.

Hourly demands are directly used in determining pumping, operational storage, and pipeline capacities, and are determined by the average-day use during the peak month, multiplied by the ratio of 24 hours over the length of the regular daily irrigation period in hours. For example, in calculating peak-hour demands, the peak-month factor would be multiplied by two if a 12-hour irrigation period is assumed, or multiplied by three if an 8-hour irrigation period is assumed.

20

System Pipeline Criteria. System piping should be evaluated under all demand conditions, but performance assessment is typically most critical under peak-hour demand conditions. Generally, pipelines 12-inch and greater in diameter are considered transmission pipelines. Because transmission pipelines impact large areas, they can accumulate large head losses from long pipe runs. These large pipeline friction losses associated with high fluid velocities need to be evaluated with respect to system delivery capacity, and contribution to lowered system pressures and excessive energy consumption.

Transmission pipelines are considered undersized if water velocities exceed 3 feet per second (fps) and head losses exceed 10 feet of head per 1,000 feet of pipe. Distribution pipelines are considered undersized if velocities exceed 5 fps and head losses exceed 10 feet of head per 1,000 feet of pipe. However, these criteria are only a guideline, and higher velocities and head losses may be tolerable under certain operating conditions such as system emergencies, and within short lengths of pumping station or reservoir yard piping where impact on system pressure is minimal.

Project Cost Data

Project cost is defined as the total capital investment necessary to complete a project, including costs for land acquisition, construction, contingencies, all necessary engineering services, and overhead items such as legal and administrative services, and financing. Probable construction cost opinions developed in this report include an allowance of 20 percent for contractor administrative expense, general overhead and profit (OH&P). Total project capital cost includes allowance for contingencies at 20 percent, and engineering and administration at 15 percent.

Construction Costs. Probable construction cost opinions cover materials, taxes, labor, mobilization/demobilization, and services necessary to build proposed facilities. These costs derive from current or adjusted historical cost information and are intended to represent median prices anticipated for each type of work. Cost estimating guides, previous studies, cost curves, and recent contract bids were used to develop cost information.

In an evaluation such as this, cost opinions are considered as defined by the American Association of Cost Engineers for preliminary design. These are opinions made without detailed engineering data and have an expected accuracy range of plus 30 percent to minus 20 percent. Actual project costs will depend on future labor and material costs, market conditions, project-specific details, and other variables. The allowance of 20 percent for contractor OH&P is calculated from the subtotal of all other construction costs, the addition of which results in the total construction cost.

Cost Index and Price Escalation. Construction costs typically undergo long-term changes in keeping with corresponding changes in the regional and national economy. A commonly accepted barometer of these changes has been Engineering New Record's Construction Cost Index (ENRCCI), which is computed from prices of construction materials and labor, and is based on a value of 100 in the year 1913.

As indicated on Figure 2-1, construction costs have been steadily increasing for many years. This figure shows ENRCCI's aggregate rate of increase for 20 major US cities, which is considered representative of construction costs in the San Diego area and, therefore, in CMWD. Project and construction costs in this report are based on a projected ENRCCI of 6,130 for January 2000 in the San Diego area.

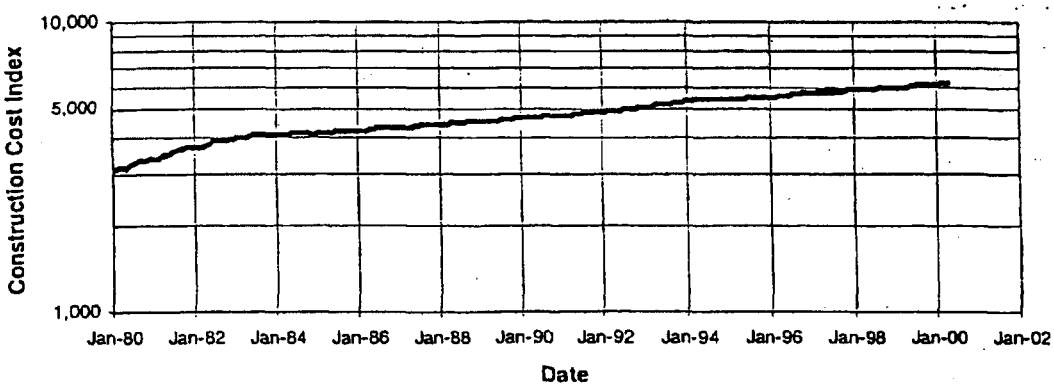


Figure 2-1 Engineering News Record Construction Cost Index

Construction Contingencies. A contingency allowance covers uncertainties associated with project design. Factors such as unusual foundation conditions, special construction methods, variation in final lengths or average depths of pipeline, and construction adjacent to existing facilities are just a few of the many items that may increase construction costs, and for which an allowance is made in preliminary design cost opinions. The cost of these items can vary greatly depending on the type and magnitude of project. An allowance of 20 percent of total construction cost is assumed to cover such contingencies, the addition of which results in the subtotal project cost.

Engineering and Administration. The cost of engineering services for major construction projects includes some or all of the following: special investigations, surveys, foundation explorations, locating interfering utilities, detailed design, preparing contract documents, construction inspection, office engineering, materials testing, final inspection, and start-up of the completed project. Depending on the size and complexity of project, total engineering, legal and administrative costs may range from 7 to 40 percent of the contract cost. The lower percentage usually applies to relatively large projects, simple projects, and

those not requiring a large amount of preliminary investigation. The higher percentage usually applies to smaller projects, projects requiring a great deal of engineering effort, or those requiring a relatively large amount of preliminary work. An allowance of 10 percent of subtotal project cost is assumed for this report.

CMWD administration charges are assumed to cover items such as legal fees, financing expenses, administrative costs and interest during construction. The cost of these items can vary, but for the purpose of this evaluation, administration charges are assumed to equal approximately 5 percent of subtotal project cost. The average total cost of all necessary engineering plus administrative services is therefore assumed to be 15 percent of the subtotal project cost, the addition of which results in the total project cost.

Chapter 3 Supply/Demand/ Storage Analysis

Mahr Reservoir has the potential to provide seasonal, emergency and operational storage for CMWD's recycled water system. The first two storage types are analyzed in this chapter. Operational storage analysis is part of ongoing related work, but outside this evaluation's scope. Results of that analysis and those of this chapter are used in Chapter 5.

Seasonal Storage

Three expansion milestones were selected at which to assess Mahr Reservoir's possible seasonal benefit to CMWD's existing and planned recycled water system:

(1) Current situation, representing an annual system demand of approximately 1,800 AFY
(2) Completion of Phase II, representing an annual system demand of approximately 5,400 AFY
(3) Ultimate expansion, representing an annual system demand of approximately 9,800 AFY

Three CMWD system scenarios were selected to quantify the reservoir's benefit at each milestone:

(A) System supply/demand fully balanced by hypothetical seasonal storage
(B) System supply/demand balanced with no seasonal storage
(C) System supply/demand balanced with Mahr Reservoir working storage

Demands. All scenarios used the same recycled water demand hydrograph, which was developed from the last five complete years of actual CMWD metered demand. A listing of monthly demand values and related statistics for the years 1995 through 1999 is provided in Appendix A. Because the months in which peak and minimum demands occur are not the same from year to year, a simple average of each month, as shown in the second-to-last row of the table in Appendix A, does not result in representative factors for accurately modeling and projecting system demand variations. Rather, it tends to reduce peak demands and increase minimum demands. Therefore, this simple average was adjusted by an algorithm to preserve the true average peak-month and minimum-month factors, which is more representative of historical seasonal fluctuations. This

adjusted average is shown in the last row of the same table. The resulting adjusted peak-month factor of 2.10 is used for subsequent facility analysis.

A unit hydrograph was developed for monthly irrigation demands based on this adjusted five-year system average. Figure 3-1 is a graphical representation of the adjusted hydrograph. Based on these adjusted factors, July has the representative peak-month demand and January has the representative minimum-month demand. This hydrograph is typical of recycled water monthly demand variations and reflects typical southern California irrigation cycles.

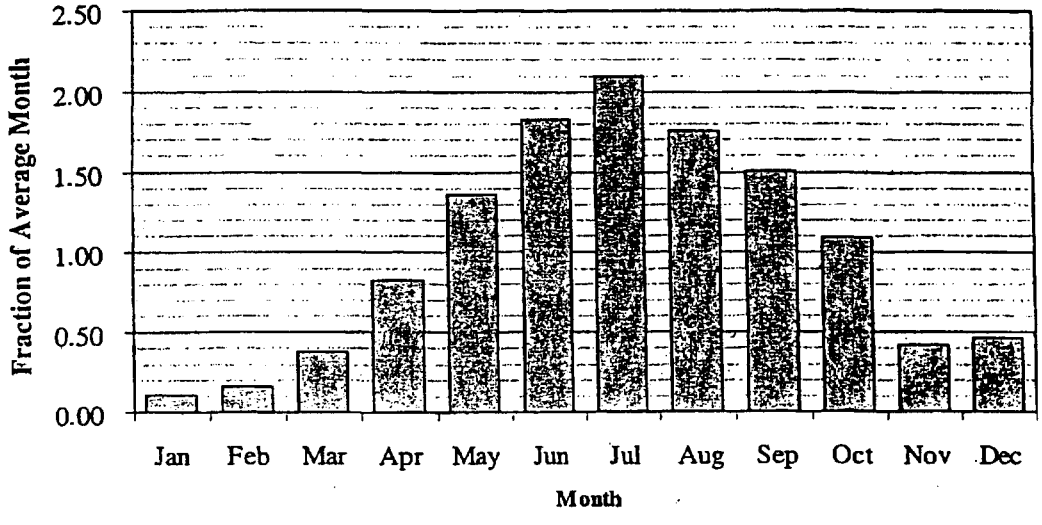


Figure 3-1 CMWD Recycled Water Demand Hydrograph

Supplies. Existing and planned CMWD recycled water supply sources include the following:

- Carlsbad Advanced Wastewater Treatment (AWT) facility, to be constructed by CMWD at the Encina Water Pollution Control Facility (WPCF), owned and operated by the Encina Water Authority
- Meadowlark WRF, owned and operated by VWD
- Gafner Water Reclamation Plant (WRP), owned and operated by Leucadia County Water District

Based on CMWD preferences, for this evaluation it is assumed that production capacities of these plants would be used in the order listed above. Estimated *available* peak-month plant supply capacities in million gallons per day (MGD) and acre-feet per month (AFM) for each of the three milestones are listed in Table 3-1. Calculated *required* plant supply capacities for each scenario, which are sometimes less, are discussed below.

Table 3-1 CMWD Recycled Water Supply Availability

Supply Source	Estimated Peak-Month Availability					
	Current		Phase II		Ultimate	
	MGD	AFM	MGD	AFM	MGD	AFM
Carlsbad AWT	0.00	0	4.00	374	15.0	1,401
Meadowlark WRF	1.70	159	2.00	187	3.0	280
Gafner WRP	0.75	70	2.00	187	2.0	187
Total	2.45	229	8.00	747	20.0	1,868

Seasonal Balancing. A computerized spreadsheet model of CMWD's recycled water system was developed to test monthly supply/demand balances, and the resulting use of seasonal storage. The model was applied to each of the three scenarios at each of the three milestones, for a total of nine analyses. For those analyses using Mahr Reservoir as seasonal storage, reservoir filling was assumed to occur in January and February, the two lowest demand months. Copies of these analyses are found in Appendix B and labeled by milestone and scenario: 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, and 3C.

A critical test for seasonal supply/demand balancing is satisfying peak-month demand, either directly from one or more supply sources, or from a combination of direct supply and water returned from seasonal storage (reservoir outflow). Peak-month results in AF from the nine analyses are summarized in Table 3-2.

Table 3-2 CMWD Peak-Month[a] Supply/Demand Balance

Milestone/ Scenario	Peak-Month Volume, AF[b]						Total Storage Volume, AF
	Demand	Required Supply				From Storage	
		Carlsbad	Meadow.	Gafner	Other[c]		
1 – Current							
A	315	0	150	0	0	165	548
B	315	0	159	70	86	0	0
C	315	0	159	70	16	70	151
2 – Phase II							
A	945	374	76	0	0	495	1,644
B	945	374	187	187	198	0	0
C	945	374	187	187	62	136	151
3 – Ultimate							
A	1,716	817	0	0	0	899	2,983
B	1,716	1,401	280	35	0	0	0
C	1,716	1,401	164	0	0	151	151

a) Peak month assumed to be July, with a peak-to-average-month ratio of 2.10, based on Figure 3-1.
b) Because of round-off, sums of volumes may differ by ±1 AF.
c) Other supply capacity assumed to be supplemented potable water.

In assessing Mahr Reservoir's seasonal benefit to CMWD's system, it is helpful to compare the reservoir with an equivalent peak-month supply source, both in

volume delivered (AF) and equivalent production rate (MGD). The estimated volume delivered from storage by Mahr Reservoir is shown in the second-to-last column for Scenario C under each of the three milestones in Table 3-2. It is also a useful perspective to see what fraction Mahr Reservoir's storage would represent of the total seasonal storage needed to fully balance the recycled water system for each of the three milestones. These data are summarized in Table 3-3.

Table 3-3 Mahr Reservoir Seasonal Benefits to CMWD

Milestone	Peak-Month Supply AF	Equivalent Peak-Month Production Rate MGD	Fraction of Fully-Balanced Storage percent
Current	70	0.75	28
Phase II	136	1.46	9
Ultimate	151	1.62	5

Because of production limitations in planned Phase II Meadowlark WRF and Carlsbad AWT expansions, 62 AF of other supply (probably potable water), in addition to Mahr Reservoir, would be needed to balance peak-month Phase II demands under Scenario 2C.

Emergency Storage

Mahr Reservoir's emergency storage benefit to CMWD's system depends on total recycled water production capacity available, demand on the distribution system, and volume of water in the reservoir, all at the time of the emergency, and time of year. Because of such a wide range of variables, only a sample analysis was performed, using the same computerized spreadsheet model noted above. As an analytical basis, the model was applied to the Phase II milestone Scenario 2C (see Appendix B), in which the routine seasonal filling of Mahr Reservoir occurred in January and February. After an assumed emergency draw-down to offset simulated lost supply in a given month, the model was constrained to refill the reservoir as quickly as possible so to be full in May, leaving the reservoir available to provide its full seasonal storage benefit. The simulated supply loss was constrained to be subsequently offset by recycled water production, up to maximum available rates, without the use of additional potable water supplement (beyond that already estimated for Scenario 2C).

Given these constraints, there were only three months during which the reservoir could provide emergency supply: February, March and April. Three simulations were run, one for an emergency supply loss in each of those three months. Copies of these analyses are found in Appendix C and captioned by volume and month of supply loss, all being labeled Scenario 2D. The following emergency storage (supply loss offset) could be provided by Mahr Reservoir: in February, 149 AF; in March, 151 AF; and in April, 131 AF.

If water were stored in the reservoir—beyond the minimum operating pool volume—over more of the year, say starting in the fall, emergency supply could be available for more months. To maintain the full seasonal benefit discussed in the previous section, no emergency storage would be available May through September. It is important to *correctly condition* emergency storage availability, so as not to inappropriately "double-count" Mahr Reservoir storage for both seasonal and emergency purposes.

Chapter 4
Facility Alternatives

Possible Facility Improvements

Mahr Reservoir's recycled water system benefit accrues both from seasonal and emergency storage value, noted in Chapter 3, and operational storage value, discussed in Chapter 5. To realize these values, facility improvements are required to mitigate known problems. These improvements could occur at the reservoir, or at other locations to affect water quality of reservoir inflow and/or outflow. The following improvements have been considered:

- Removing nutrients from reservoir inflow at the wastewater treatment plants
- Modifying the existing reservoir I/O works, with multiple ports for best seasonal water stratum selection
- Adding an aeration/destratification system in the reservoir
- Adding chlorination to reservoir outflow
- Reusing existing microscreens, either at Meadowlark WRF or relocated to Mahr Reservoir, to remove suspended material from reservoir outflow
- Adding reservoir lining and covering

Wastewater Inflow Nutrient Removal. Phosphorus and nitrogen are macronutrients for algae and other plant growth. Both constituents are typically present in wastewater at concentrations many times higher than growth limiting values. Removing phosphorus from reservoir inflow would typically involve chemical precipitation as part of primary treatment at a wastewater treatment plant. Removing nitrogen would typically involve nitrification/denitrification as part of secondary treatment at a wastewater treatment plant.

While Meadowlark WRF is physically closest to Mahr Reservoir, planned system-wide recycled water production, as illustrated in Chapter 3, projects Carlsbad AWT production to dominate the recycled water blend, even in Phase II. In addition, Gafner WRP's Phase II production is projected to be comparable to Meadowlark WRF's. Therefore, one or both nutrient removal processes would have to be implemented at all three plants to substantially control nutrients.

Each nutrient removal process adds significant cost to a wastewater treatment plant's liquid stream and incidental cost to a plant's solids stream. While substantial nutrient reduction at each plant would help control algae growth in the reservoir, the nutrient loss is a disbenefit to the recycled water system's irrigation

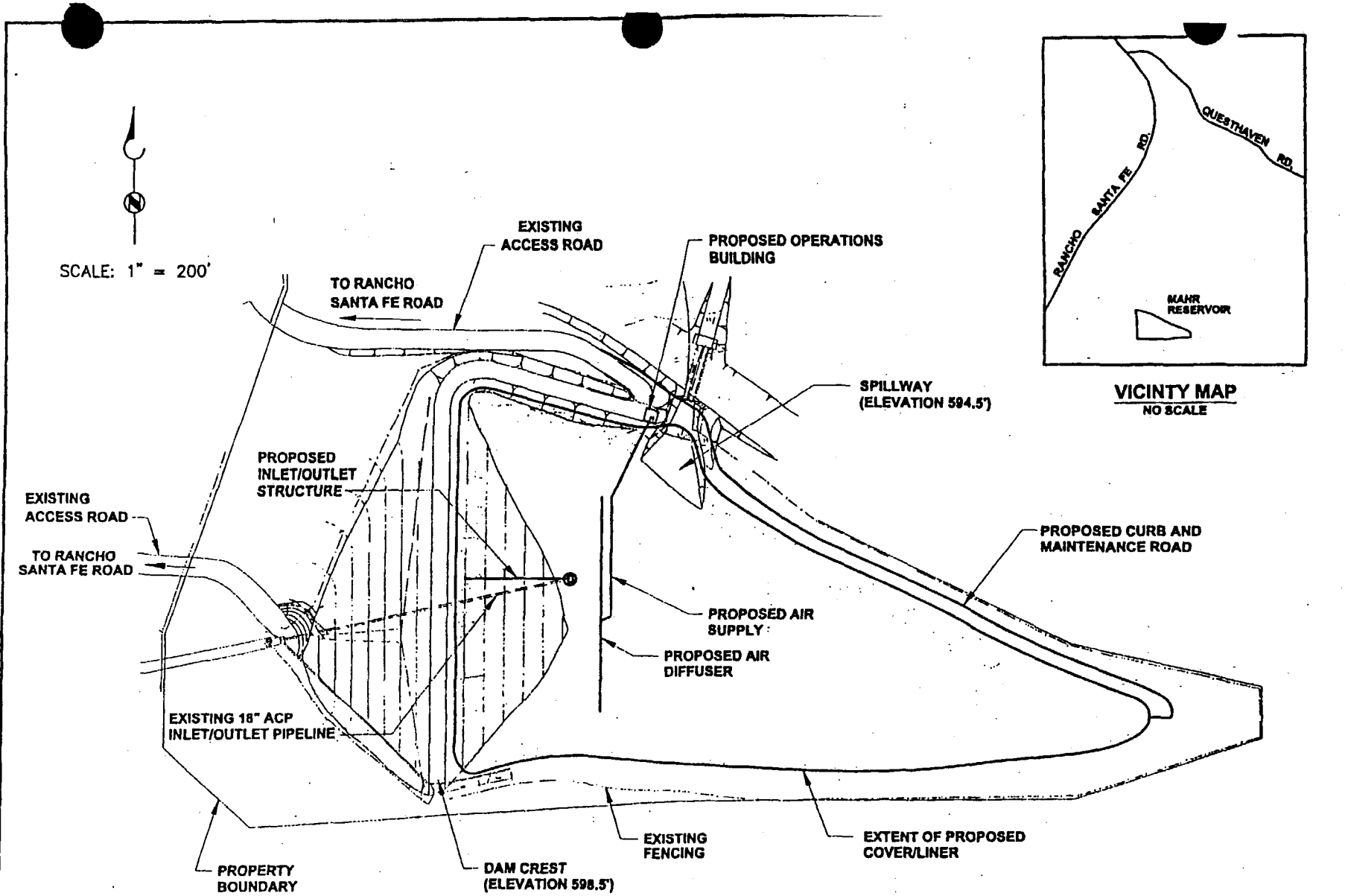
customers. Various studies have valued the typical wastewater nutrient fertilizer "credit" at $40 to $50 per acre-foot. Estimating the precise benefit to the reservoir of a given amount of nutrient removal would require a detailed analysis of the combined plant effluents and water stored in the reservoir. The analysis would then determine limiting nutrient quantities, which typically involve very low concentrations, as treatment process target values. These estimations are beyond this evaluation's scope, and this candidate improvement is not considered further.

Modified I/O Works. The current reservoir I/O works has only one set of openings around elevation 550 feet, only a few feet above the basin bottom. An improved I/O works would have multiple sets of openings, say four additional, equally spaced, approximately 9 feet apart vertically. This would allow selective water withdrawal from the stratum having the seasonally best water quality, e.g., avoiding a layer of algae in the top 5-10 feet of water, and avoiding intake of bottom sediment.

There are two basic I/O works configurations: a free-standing tower rising from the reservoir bottom, and a laid-back structure secured to the upstream dam face. A free-standing tower could in concept be constructed on top of the existing I/O works. A laid-back structure could be connected between the existing I/O works and the toe of the upstream dam face. A review of conceptual design considerations for the two alternatives indicated the latter alternative would be less disruptive, probably less expensive, and therefore, preferable. Either I/O modification would require review by the State of California, Division of Safety of Dams (DSOD). Key consideration by DSOD would be maintaining adequate and controllable reservoir draw-down capability for dam emergencies.

The plan location of the modified I/O works with respect to the existing works and other existing and proposed reservoir features is shown on Figure 4-1. A drawing of a laid-back I/O structure is shown on Figure 4-2. Four I/O port valves would be provided for selecting the best quality water stratum, and an additional valve would isolate the existing works. The latter valve would be normally closed, and this existing opening used as a fifth regular I/O port and as an emergency outlet to satisfy jurisdictional dam draw-down requirements.

Preliminary sizing of I/O works components was based on hydraulic network analyses of proposed CMWD recycled water distribution system expansions, which are represented in the recently completed *Encina Basin Recycled Water Distribution System Study*. Although volumes associated with Mahr Reservoir's operational storage function are relatively small compared with those of seasonal storage, operational storage peak-hour hydraulic requirements should be used to size I/O piping and valves. Table 4-1 lists peak-hour withdrawal rates estimated in the above-noted work for the Phase II and ultimate system expansions. As additional recycled water production capacity and operational storage volumes elsewhere are ultimately developed, the peak-hour demand on Mahr Reservoir's storage decreases from Phase II to the ultimate condition. Hence, the estimated



05/19/00 at 04:00:48pm P:\207-01\20701-RC4-1.dwg

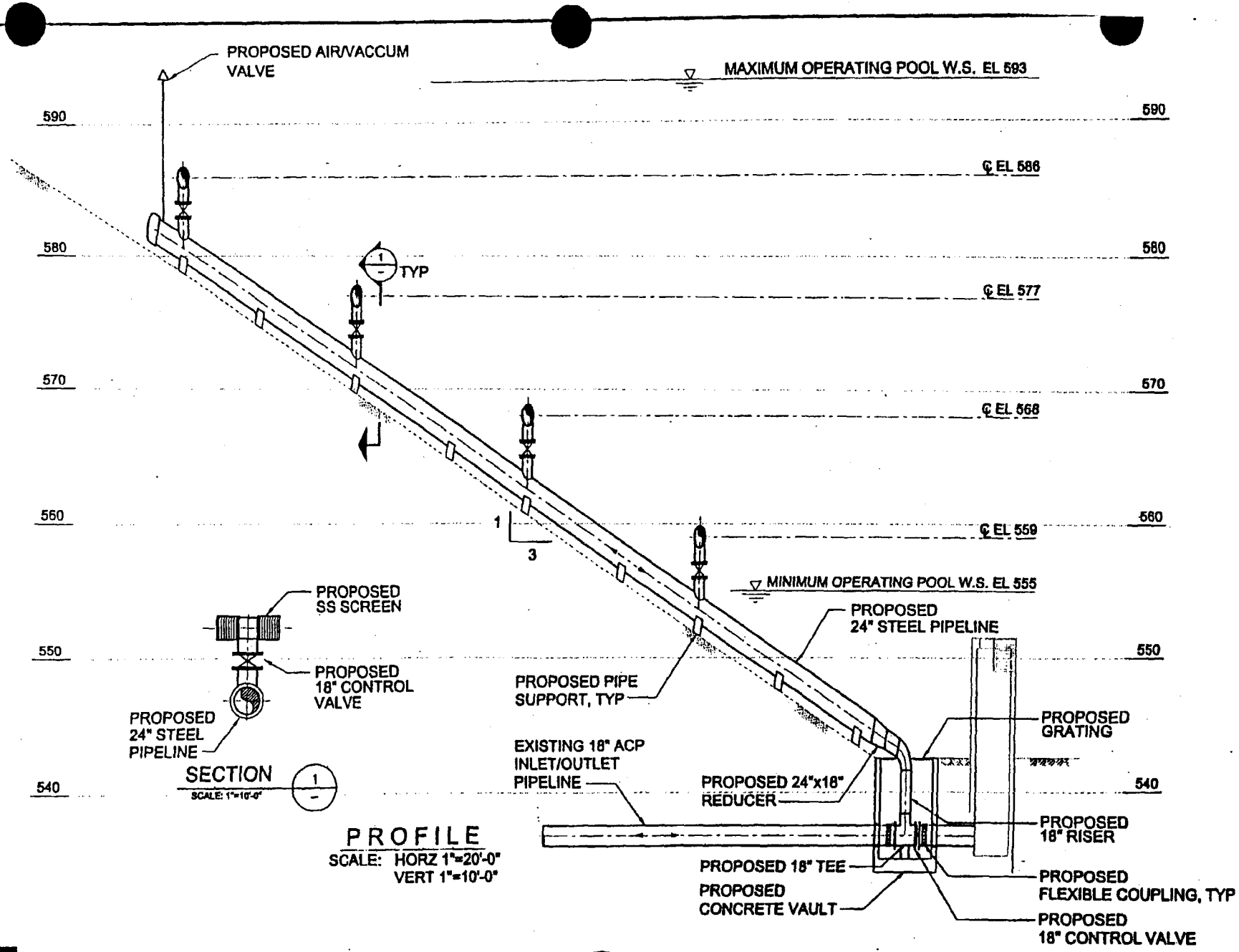
CATHCART GARCIA VON LANGEN

CGvL ENGINEERS

IN ASSOCIATION WITH
JOHN POWELL & ASSOCIATES

CARLSBAD MUNICIPAL WATER DISTRICT

FIGURE 4-1 PROPOSED MAHR RESERVOIR IMPROVEMENTS



CAMCART GARCIA VON LANGEN

CGvL ENGINEERS

IN ASSOCIATION WITH
JOHN POWELL & ASSOCIATES

CARLSBAD MUNICIPAL WATER DISTRICT

FIGURE 4-2 PROPOSED MAHR RESERVOIR I/O WORKS

06/27/00 at 09:16:09am P:\207-01\20701-FIG4-2.dwg

Phase II peak-hour withdrawal rate is higher than the ultimate rate, and the Phase II rate should be used for I/O works sizing.

Because the runs are short, the existing 18-inch I/O pipeline, which lies under the dam, and proposed extension up the dam face should be considered as distribution pipelines for sizing. As shown in Table 4-1, peak-hour velocities in the existing 18-inch I/O pipeline will exceed normal hydraulic design criteria discussed in Chapter 2. This situation would improve from Phase II to the ultimate condition. The higher velocities could be tolerated in the existing piping, since its replacement or paralleling would be extremely difficult, but the proposed extension to the works should use 24-inch piping, the nearest regular pipe size satisfying hydraulic design criteria.

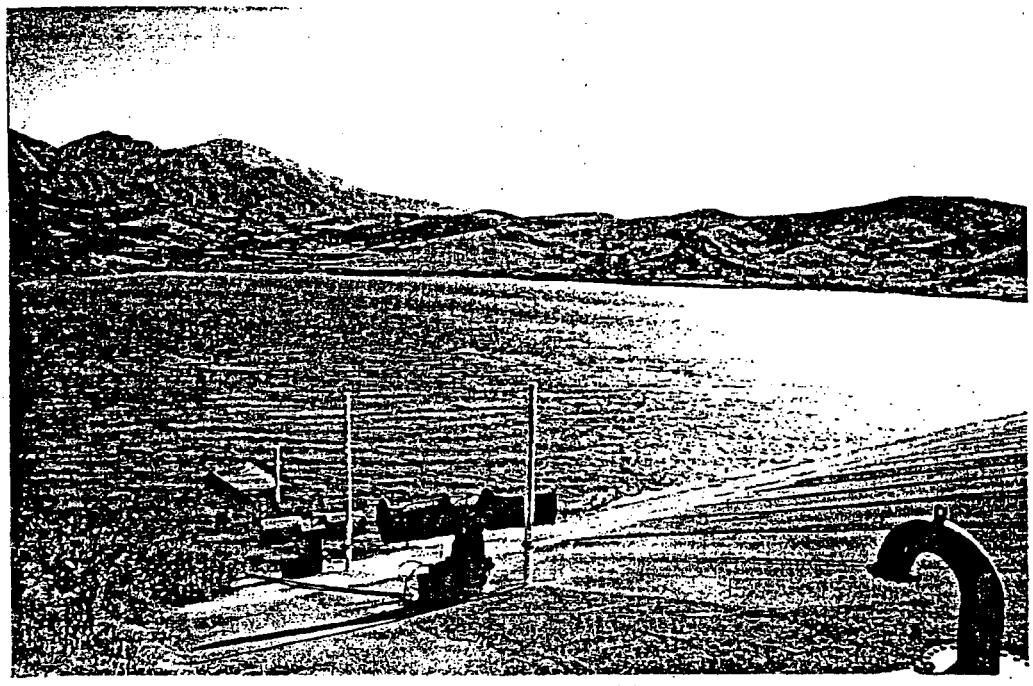
Table 4-1 Mahr Reservoir I/O Hydraulic Parameters

Parameter	Units[a]	Milestone	
		Phase II	Ultimate
Peak-Hour Flow	gpm	7,947	6,473
Based on Existing I/O Pipeline Diameter (18 inches)[b]:			
Pipe Velocity	fps	10.6	8.6
Based on Hydraulic Criteria Diameter (24 inches)[b]:			
Pipe Velocity	fps	5.6	4.6

a) Unit abbreviation: gpm = gallons per minute.
b) Using a friction factor of C = 120.

Because the total headloss difference between a 24-inch and 18-inch valve is relatively small, and the cost difference relatively larger, 18-inch valves are assumed for the four proposed new I/O port controls. Each I/O port would be protected from coarse suspended material by appropriate stainless steel screens. The arrangement of these screens is highlighted on Figure 4-2, and a photograph of similar I/O port screens at SMWD's Upper Oso Reservoir is shown on Figure 4-3. All valves would be hydraulically operated with control lines terminating in a proposed operations building at the reservoir's north side, as shown on Figure 4-1. A probable cost opinion of the modified I/O works is given in Table 4-2.

Aeration/Destratification System. A body of water like Mahr Reservoir, several feet deep or more, will naturally tend to undergo thermal stratification. Because of solar heat load, upper and lower waters tend to become thermodynamically "separate" with respect to uniform mixing. Upper waters tend to stay well mixed and aerobic, while lower waters become stagnant and anoxic. The latter environment, especially with chemicals present in recycled water, can promote hydrogen sulfide and other odiferous chemical production. With CMWD's climate, one stratification cycle per year will occur, with onset in spring, greatest stratification in late summer, natural mixing or "turnover" in fall, and well-mixed water in winter.



Upper two I/O ports, looking east.

Figure 4-3 Upper Oso Reservoir I/O Works

An aeration system can perform substantial mixing of the reservoir volume and provide supplemental oxygen. This mixing can prevent or eliminate stratification, and its undesirable consequences, and even help control certain algae growth. Typical Southern California experience shows the system only needs to operate part of the day or a few days a week, and only during the spring-to-fall half of the year.

A common system configuration, used in several reservoirs and lakes in San Diego and Orange Counties, includes an air compressor, usually housed in a small building for protection and sound attenuation; an air supply pipeline; and a diffuser pipeline, usually located 5-10 feet above the bottom near the deepest portion of the basin. Keeping this diffuser pipeline well submerged is one reason to establish a 12.5-foot deep minimum operating pool, discussed in Chapter 1. The operations building noted above could house both the I/O works valve controls and the aeration/destratification system's compressor. Location of these features is shown on Figure 4-1. A photograph of the proposed operations building site is provided as Figure 4-4.

50

Table 4-2 Cost Opinion for Mahr Reservoir I/O Works

Item	Quantity		Material Cost dollars		Labor Cost dollars		Total Cost dollars[b]
	No.	Unit[a]	Unit	Total	Unit	Total	
Demolition Work	1	LS	0	0	20,000	20,000	20,000
Concrete Vault							
Excavation	33	CY	40	1,320	20	660	1,980
Backfill	16	CY	40	640	20	320	960
Concrete	10	CY	200	2,000	400	4,000	6,000
Shoring	5	ton	600	3,000	360	1,800	4,800
24-Inch Steel Pipe w/Epoxy Coating	140	ft	115	16,100	105	14,700	30,800
Welding Joints	30	each	315	9,450	33	990	10,440
18x18x18-inch Tee w/Epoxy Coating	5	each	900	4,500	982	4,910	9,410
18-inch 90-degree Elbows w/Epoxy Coating	1	each	950	950	769	769	1,719
24x18-inch Reducer w/Epoxy Coating	1	each	680	680	763	763	1,443
24x24x18-inch Tee w/Epoxy Coating	4	each	1,730	6,920	1,126	4,504	11,424
Flexible Coupling	2	each	500	1,000	650	1,300	2,300
18-inch BFV w/ Hydraulic Cylinder	5	each	5,000	25,000	2,500	12,500	37,500
Stainless Steel Wire Screen	4	each	3,500	14,000	1,500	6,000	20,000
Hydraulic Accumulator System	1	each	32,000	32,000	41,000	41,000	73,000
Pipe Support	20	each	250	5,000	500	10,000	15,000
Miscellaneous Metalwork	1	LS	3,500	3,500	1,558	1,558	5,058
Electrical/Instrumentation	1	LS	12,000	12,000	5,900	5,900	17,900
Sales Tax on Material Cost, 7.75 percent							10,700
Mobilization & Demobilization, 3 percent							8,092
Subtotal Construction							**288,526**
Contractor OH&P	20 percent						57,705
Total Construction							**346,231**
Contingency	20 percent						69,246
Subtotal Project							**415,477**
Engineering & Administration	15 percent						62,322
Total Project							**477,799**

a) Unit abbreviations: LS = lump sum; CY = cubic yard.
b) Cost for January 2000.

Wide spot in access road, looking east over spillway.

Figure 4-4 Proposed Mahr Reservoir Operations Building Site

For durability and flexibility, the air supply and diffuser pipelines are assumed constructed of 4-inch diameter polyethylene piping. The diffuser pipeline would have small, appropriately-sized holes drilled approximately every five feet for its entire length. This pipeline would be held in place, approximately parallel to the reservoir bottom, by a series of anchors that resist the pipeline's tendency to rise when charged with air. This type system has been operating at SMWD's Upper Oso Reservoir for approximately ten years. While other aeration/destratification systems are feasible, a probable cost opinion for the one described here, with costs adjusted from SMWD's experience, is presented in Chapter 5.

Outflow Chlorination. Open seasonal storage generally degrades bacteriological water quality below those levels specified by Title 22, California Code of Regulations, for disinfected tertiary effluent at a treatment plant production source. The extent of degradation depends on the size of the drainage area tributary to the reservoir and the development characteristics of the drainage area. While not currently required by regulatory agencies, chlorination of reservoir outflow could be done to mitigate this degradation. Because of no regulatory requirement for outflow disinfection, the very small Mahr Reservoir tributary watershed area, and no predominant outflow chlorination practice elsewhere

specifically for disinfection, this candidate improvement is not considered further. It could be reconsidered for a future phase of work.

Outflow Microscreening. Reusing the existing fine screens could provide some control of water quality, although distribution system algae problems still occurred during the original deployment. Such reuse would involve improvements in situ at the Meadowlark WRF or equipment relocation to the Mahr Reservoir site. Some WRF process and related modifications could be required.

A significant drawback to outflow microscreening is the need to break head. Mitigating this hydraulic disruption would require pumping designed for peak-hour flow rate and complex pump controls. In light of these disadvantages, and the years of several major recycled water storage reservoirs (see Chapter 1) operating successfully without such treatment, this candidate improvement is not considered further.

If the need emerges to remove particulate matter in reservoir outflow beyond that removal accomplished by the proposed I/O port screens, large and relatively inexpensive strainers of the type used by SMWD for Upper Oso Reservoir could be deployed. These could be installed in-line, with no head break, on the existing 18-inch I/O line near where it emerges from the downstream dam toe. In normal operation such strainers involve a typical headloss of only a few pounds per square inch.

Reservoir Lining and Covering. Lining and covering a reservoir can control algae growth and other water parameters. Two lining and covering alternatives were considered candidates for Mahr Reservoir:

- Alternative A – a floating cover with a geo-membrane liner
- Alternative B – a floating cover with a porous asphaltic-cement (AC) liner

The geometric configuration of the existing reservoir was reviewed for compatibility with the two commonly used systems for maintaining tension on a floating cover: weight-tensioning and mechanical-tensioning. Weight-tensioned floating covers are distinguished by a series of strategically located trough weights and floats attached to the floating cover to take up excess material and keep the floating cover taut. These trough weights create a fold where excess material accumulates and that also serves as a rainwater collection trough. Rain falling on the floating cover migrates into the troughs and is removed by a rainwater removal system, consisting of pumps or gravity drain assemblies.

With mechanically-tensioned floating covers, cables are attached to the floating cover and connected to a counter-weight and pulley system to maintain floating cover tension. The counterweights are housed in a number of small individual towers surrounding the reservoir perimeter. The rainwater removal system

typically consists of pumps or gravity drains placed on the floating cover to remove surface water.

Both these cover systems have very similar estimated unit costs. The reservoir site can be reconfigured to suit either cover system; however, the mechanically-tensioned cover system would only be practical if the operating water level of the reservoir was restricted to the upper 15 feet of its range. A weight-tensioned cover system would allow the full operating range in the existing reservoir to be used. Therefore, for this evaluation, a weight-tensioned cover system, with 45-mil polypropylene cover material and full perimeter sump, is considered for budget pricing of both lining and covering alternatives.

Recommended impermeable geo-membrane liners for this application include a 45-mil polypropylene liner or a 60- to 90-mil high-density polyethylene (HDPE) liner. HDPE liners are cheaper, but have a higher coefficient of thermal expansion, making installation and maintenance more complicated. For this evaluation, the 45-mil polypropylene liner is considered for budget pricing for Alternative A.

It is anticipated that the addition of an impermeable geo-membrane would require careful review by a geotechnical engineer and DSOD. Key items for consideration by DSOD would be potential loss of soil moisture in the dam embankment, under-drain piping and under-drain relief piping. The loss of moisture in the dam embankment could be significant as the dam core appears to be constructed with clay, based on available record drawings. It is likely the under-drain relief piping could require penetrating the dam embankment to discharge under-drain flows.

Other items that are typically part of an existing reservoir retrofit with a floating cover and a geo-membrane liner include:

- A means to anchor the edge of the liner
- Appurtenances such as vents, access hatches, and inflation ports
- A rainwater relief system

A probable construction cost opinion for adding a floating cover and geo-membrane liner to Mahr Reservoir is shown in Table 4-3. The costs for the basic appurtenances described above are included in the unit cost for the cover and are based on past experience with similar projects.

As described above, it is anticipated that a geo-membrane liner system may not be compatible with the existing dam embankment and would require considerable review by DSOD. Therefore, porous AC liner system, Alternative B, was reviewed as another method for lining the reservoir. This type of liner system would not require an under-drain system and under-drain relief piping. This alternative would likely reduce requirements for DSOD permitting.

Table 4-3 Cost Opinion for Lining and Covering Mahr Reservoir

Item[a]	Quantity[e]	Unit Cost	Total Cost, dollars[f]	
			Alternative A	Alternative B
Porous AC Liner	385,000	$1/SF	N/A	385,000
Polypropylene Liner	385,000	$1/SF	385,000	N/A
Underdrain (in reservoir)	1,600	$25/LF	40,000	N/A
Underdrain (through embankment)	500	$40/LF	20,000	N/A
Base[b]	115,500	$0.75/SF	86,625	86,625
Polypropylene Cover & Appurtenances[c]	350,000	$2.10/SF	735,000	735,000
Concrete Ringwall Appurtenances	2,900	$40/LF	116,000	116,000
Excavation[d]	1	LS	100,000	100,000
Subtotal Construction			**1,482,625**	**1,422,625**
Contractor OH&P	20 percent		296,525	284,525
Total Construction			**1,779,150**	**1,707,150**
Contingency	20 percent		355,830	341,430
Subtotal Project			**2,134,980**	**2,048,580**
Engineering & Administration	15 percent		320,247	307,287
Total Project			**2,455,227**	**2,355,867**

a) This estimate only includes costs for work associated with the liner and cover. Costs for inlet and outlet structures, minor concrete, and other miscellaneous work have not been included.
b) Base quantity assumes a bottom area with 6" thick decomposed granite base. Type and cost of base may change based on a detailed geotechnical evaluation.
c) Appurtenances include vents, access hatches, inflation ports, and rainwater relief system.
d) Excavation cost may change based on actual site conditions and method of excavation.
e) Volume = 160 AF, surface area = 350,000 square feet (SF), bottom area = 385,000 SF, perimeter = 2,900 linear feet.
f) Cost for January 2000.

A probable cost opinion for adding a floating cover with a porous AC liner to Mahr Reservoir is also shown in Table 4-3. The cost for basic appurtenances described above are also included in the unit cost for the cover. These costs are based on past experience with similar projects and accepted cost references.

In order to install either alternative lining and covering system, the existing reservoir would require draining, debris/sludge removal, dewatering and remedial grading to reconfigure the side slopes and reservoir bottom. Prior to liner system installation, base material would be placed as recommended by a geotechnical engineer. For the purposes of this evaluation, allowances have been made for excavation and installation of base material, based on similar projects.

Operation and maintenance costs for a floating cover and liner system depend somewhat on liner alternative. These can be estimated if a decision is made to pursue either lining and cover alternative further.

As shown in Table 4-3, Alternatives A and B have comparable costs; however, Alternative B would not require a possible change to the design intent of the dam embankment nor would it require a piping penetration through the embankment for under-drain relief. For these reasons, it is believed that the Alternative B

would be easier to design, permit and maintain. Based on results of this evaluation, the floating cover with a porous AC liner is considered further in Chapter 5.

Miscellaneous Site Work. Other more minor site improvements may be required in addition to the major ones previously discussed. These items could include improving site access roadways, adding selective landscape treatment, and installing a protective surface on the upstream dam face. The latter could be accomplished with AC pavement, which would mitigate erosion as well as decrease "foothold" for rooted aquatic vegetation. A lump cost opinion is provided for these items in Chapter 5.

Alternative Combinations of Improvements

Two types of facility alternatives are defined: using or not using Mahr Reservoir in the planned recycled water system; and, if the decision is to use Mahr Reservoir, selecting the best combination of facility improvements. To make a fair comparison when Mahr Reservoir is not to be used, equivalent seasonal, operational, and emergency supply components must be considered. These could include additional peak-month supply capacity and an above-ground operational storage reservoir, respectively. These alternatives and cost opinions thereof are discussed in Chapter 5.

The long-term history of other recycled water seasonal storage reservoirs, discussed in Chapter 1, argues strongly against the need for a lining and covering system at Mahr Reservoir. Given that and the relatively large cost of lining and covering systems, two combinations of improvements are considered. The first combination involves the following improvements:

- Dredging and cleaning the reservoir bottom
- Modifying the I/O works
- Adding an aeration/destratification system
- Performing miscellaneous site work.

The second combination involves all the above plus adding lining and covering.

Since Mahr Reservoir has a very small tributary watershed area, the first combination of improvements should provide adequate water quality. Dredging and cleaning, and use of aeration/destratification will tend to maintain an aerobic environment throughout the reservoir water column throughout the year. This will tend to eliminate hydrogen sulfide production and other unpleasant odors. Multiple ports in a modified I/O works will tend to allow best quality water stratum selection. Since algae grow largely near the reservoir water surface, this will tend to greatly minimize the likelihood of algae being moved into the distribution system.

An additional reason, besides cost, exists for deferring further consideration for reservoir lining and covering. In 1997 the State Department of Health Services published a comprehensive evaluation of reservoir lining and covering systems. Their primary focus was a sanitary assessment with respect to potable water storage and quality. However, they noted some generic concerns that would be relevant to application with high-quality recycled water as planned by CMWD:

- Cover materials are "vulnerable to puncture" and "slashes," as from vandalism, and cover seams are "potential weak spots that can compromise the watertight integrity"
- Drainage systems used to remove accumulated rainwater are "not reliable"
- Many of the agencies that have installed lining and covering systems "have attempted to establish... a (maintenance) program but found this process to be exceedingly difficult, labor intensive, and expensive."

Chapter 5 Alternative Costs and Phasing

Mahr Reservoir Use Benefits

Mahr Reservoir can provide seasonal, operational (diurnal), and emergency storage to CMWD's recycled water production and distribution system. Seasonal and emergency storage benefits are quantified in Chapter 3. Absent Mahr Reservoir, CMWD's system would need equivalent peak-month supply capacity. This would require, for comparative analysis, a marginal increase in peak-month supply from the Carlsbad AWT facility, according to the flow rates given in Table 3-3.

From an operational storage perspective, Mahr Reservoir is favorably located geographically and topographically. It provides a storage volume well suited to service demand along Rancho Santa Fe Road, both north and south of the reservoir site, and it could back-feed flow into the lower distribution system pressure zone. The reservoir is also at a key elevation for establishing the hydraulic grade line in the nearby portion of the distribution system. Absent Mahr Reservoir, the system would need equivalent operational storage capacity. This would require, for comparative analysis, an alternative 1.5-MG reservoir at a site in the vicinity near elevation 550 feet.

From an emergency storage perspective, Mahr Reservoir's volume could offset a loss of supply at one of the regular production sources for a given period of time. The appropriate volume would vary depending on total system production capacity available, demand on the distribution system, volume of water in the reservoir, and time of year. For example, if a supply outage occurred in the peak demand month, the volume withdrawn for emergency supply offset would directly eliminate a corresponding volume of peak-month seasonal storage. Emergency storage remains a benefit for Mahr Reservoir, but it is difficult to quantify monetarily. Sample volumetric approximations are given at the end of Chapter 3.

Another possible benefit of Mahr Reservoir relates to ocean outfall capacity. During the winter, Encina WPCF may incur hydraulic limitations in peak wet-weather treated wastewater disposal capacity. Water reclamation, via the

proposed Carlsbad AWT facility, could remove some flow from the disposal stream. Because of low winter demand, such excess recycled water would have to be stored. However, according to the analyses included in Appendix B, even in the current condition, Mahr Reservoir's volume is relatively small and would *not necessarily* take enough flow in the winter to save significant treated wastewater disposal capacity in the ocean outfall system. Appropriate estimations of realistic volumes would require more detailed modeling of Encina WPCF and are beyond this evaluation's scope. Therefore, no benefit is quantified for this function.

Comparative Improvement Costs

For Phase II cost comparison, Alternative 1 includes use of Mahr Reservoir and all the facility improvements summarized at the end of Chapter 4. Alternative 2 replaces Mahr Reservoir with an equivalent new 1.5-MG, above-ground, steel, operational storage reservoir on a newly-purchased site; and 1.46-MGD additional peak-month equivalent supply capacity (see Table 3-3), assumed as a marginal increase to planned Carlsbad AWT expansion capacity. Table 5-1 shows resulting capital costs by line item and totals.

Table 5-1 Comparative Costs for Mahr Reservoir Phase II Capacity Value

Item	Quantity	Unit Cost	Total Cost, dollars[e]	
			Alternative 1[f]	Alternative 2[g]
With Mahr Reservoir				
Dredging & Cleaning[a]	1	lump sum	150,000	N/A
Modified I/O Works[a]	1	lump sum	289,000	N/A
Aeration/Destratification System[a]	1	lump sum	166,000	N/A
Lining and Covering[b]	160 AF	lump sum	1,423,000	N/A
Miscellaneous Site Work[a]	1	lump sum	175,000	N/A
Without Mahr Reservoir				
New Oper. Storage Res. Site[a]	1 acre	lump sum	N/A	100,000
New Oper. Storage Res. Construction[c]	1.5 MG	413,000	N/A	620,000
Additional Peak-Month Plant Capacity[d]	1.46 MGD	1,167,000	N/A	1,704,000
Subtotal Construction			**2,203,000**	**2,424,000**
Contractor OH&P	20 percent		441,000	485,000
Total Construction			**2,644,000**	**2,909,000**
Contingency	20 percent		529,000	582,000
Subtotal Project			**3,173,000**	**3,491,000**
Engineering & Administration	15 percent		476,000	524,000
Total Project			**3,649,000**	**4,015,000**

a) Preliminary estimate.
b) Cost based on lining and covering Alternative B.
c) Volume sized per final distribution system analysis.
d) Capacity based on Chapter 3 analysis, shown in Table 3-3; cost based on incremental capital improvements in *Preliminary Design Report for the Carlsbad Water Recycling Facility.*
e) Cost for January 2000; assumes remainder of recycled water supply and distribution costs for a total Phase II system at 5,400 AFY is the same for both alternatives.
f) Assumes Mahr Reservoir improved for use as operational and seasonal storage.
g) Assumes equivalent operational storage and peak-month supply capacity obtained without Mahr Reservoir.

At this estimating level, Alternative 1's total project cost is slightly less than Alternative 2's total project cost. Alternative 2's total project cost would change a small amount if a different capacity operational storage reservoir were used and if a different plant capacity were chosen. More significantly, Alternative 2's total project cost would increase for the ultimate condition, while Alternative 1's total project cost would not. In that condition, an estimated 3.5 MG of alternative operational storage and a total additional peak-month plant capacity of 1.62 MGD (see Table 3-3) would be needed, which would increase Alternative 2's total project cost by approximately $1,842,000, as shown in Table 5-2. Considering these additional costs to Alternative 2 and the monetarily unquantified emergency storage benefit of Alternative 1, Alternative 1 appears the least-cost capital option.

Table 5-2 Comparative Costs for Mahr Reservoir Ultimate Capacity Value

Item	Quantity	Unit Cost	Total Cost, dollars[d]	
			Alternative 1[e]	Alternative 2[f]
With Mahr Reservoir				
Per Table 5-1	1	lump sum	2,203,000	N/A
Without Mahr Reservoir				
New Oper. Storage Res. Site[a]	2 acres	lump sum	N/A	200,000
New Oper. Storage Res. Construction[b]	3.5 MG	413,000	N/A	1,446,000
Additional Peak-Month Plant Capacity[c]	1.62 MGD	1,167,000	N/A	1,891,000
Subtotal Construction			**2,203,000**	**3,537,000**
Contractor OH&P	20 percent		441,000	707,000
Total Construction			**2,644,000**	**4,244,000**
Contingency	20 percent		529,000	849,000
Subtotal Project			**3,173,000**	**5,093,000**
Engineering & Administration	15 percent		476,000	764,000
Total Project			**3,649,000**	**5,857,000**

a) Preliminary estimate.
b) Volume estimated from ratio of ultimate to Phase II demands.
c) Capacity based on Chapter 3 analysis, shown in Table 3-3; cost based on incremental capital improvements in *Preliminary Design Report for the Carlsbad Water Recycling Facility.*
d) Cost for January 2000; assumes remainder of recycled water supply and distribution costs for a total ultimate system at 9,800 AFY is the same for both alternatives.
e) Assumes Mahr Reservoir improved for use as operational and seasonal storage.
f) Assumes equivalent operational storage and peak-month supply capacity obtained without Mahr Reservoir.

Operating costs for Mahr Reservoir would be relatively minor, and probably comparable to those associated with Alternative 2. They are not considered herein because they would not be expected to affect the decision.

Improvement Phasing

If lining and covering were deleted from Alternative 1, the resulting total cost would be substantially less than the cost for any version of Alternative 2. Alternative 1 could be phased, with initial Mahr Reservoir improvements for Phase II including all items except lining and covering, which would be deferred as discussed in Chapter 4. These Phase II reservoir improvements could be tested for several years before reconsidering the need for additional reservoir improvements. If lining and covering were needed, it could be constructed as part of a Phase III system expansion. Based on Table 5-1, the total project cost opinion for initial reservoir improvements under Alternative 1 is shown in Table 5-3.

Table 5-3 Cost Opinion for Initial Mahr Reservoir Improvements[a]

Item	Quantity	Unit Cost	Total Cost dollars
Dredging & Cleaning	1	lump sum	150,000
Modified I/O Works	1	lump sum	289,000
Aeration/Destratification System	1	lump sum	166,000
Miscellaneous Site Work	1	lump sum	175,000
Subtotal Construction			780,000
Contractor OH&P	20 percent		156,000
Total Construction			936,000
Contingency	20 percent		187,000
Subtotal Project			1,123,000
Engineering & Administration	15 percent		168,000
Total Project			1,291,000

a) All entry notes same as for Table 5-1.

Chapter 6
Recommendations

Facilities

In light of the foregoing evaluation and related ongoing preliminary design of CMWD's recycled water distribution system, the following recommendations are made to CMWD regarding Mahr Reservoir:

- Proceed with acquisition of rights from VWD to improve and use the reservoir on a long-term basis
- Phase reservoir improvements as delineated in Chapter 5, with further consideration for a liner and cover deferred to system expansion Phase III
- Design and construct all initial reservoir improvements in parallel with other Phase II system expansion improvements
- Once the improved reservoir is placed in service, test its performance for several years before reconsidering the need for additional improvements.

Monitoring Program

To properly test performance of an improved Mahr Reservoir, an adequate monitoring program will need to be initiated. Such a program typically requires use of a boat for sample acquisition and use of a portable analyzer to measure common limnetic parameters at different depths. Table 6-1 illustrates a typical program, with samples collected in the water column between the existing reservoir I/O works and the upstream dam toe. Daily sample timing would depend on operating times of the proposed aeration/destratification system and any specific regulatory requirements.

Table 6-1 Mahr Reservoir Monitoring Program

Parameter	Method	Depth	Frequency
Dissolved Oxygen	Analyzer	Every 5 feet	Monthly
Temperature	Analyzer	Every 5 feet	Monthly
pH	Analyzer	Every 5 feet	Monthly
Electrical Conductivity	Analyzer	Every 5 feet	Monthly
Oxidation-Reduction Potential	Analyzer	Every 5 feet	Monthly
Turbidity	Analyzer	Every 5 feet	Monthly
Coliform	Grab	Top	Monthly
General Mineral	Grab	Top and Bottom	Quarterly

At the program's onset, similar samples could be collected at a few other locations around the reservoir, to verify that the recommended sample location is adequately representative of the entire water body.

\\NTSERVER\SHARED.FIL\PROJECTS\Powell.207\Carlsbad Ph II.001\Reservoir\Mahrreserval.Doc

Appendix A

HISTORICAL RECYCLED WATER DEMANDS

CMWD Recycled Water System
Historical Monthly Recycled Water Demands[a] (acre-feet), 1995-1999

Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals	Average	Factors[c] P/A	Factors[c] M/A
1995	Use	18.26	10.65	9.54	42.04	89.83	127.00	149.24	193.48	181.99	128.61	78.10	62.08	1,090.82	90.90		
	Ratio[b]	0.20	0.12	0.10	0.46	0.99	1.40	1.64	**2.13**	2.00	1.41	0.86	0.68			2.13	0.10
1996	Use	33.93	12.11	16.70	89.48	152.55	223.57	198.31	203.14	158.07	130.26	29.78	10.93	1,258.83	104.90		
	Ratio[b]	0.32	0.12	0.16	0.85	1.45	**2.13**	1.89	1.94	1.51	1.24	0.28	0.10			2.13	0.10
1997	Use	11.24	34.59	108.29	132.47	181.82	215.65	179.32	171.35	152.62	110.35	24.06	26.26	1,348.01	112.33		
	Ratio[b]	0.10	0.31	0.96	1.18	1.62	**1.92**	1.60	1.53	1.36	0.98	0.21	0.23			1.92	0.10
1998	Use	14.22	22.29	50.91	90.73	161.27	228.75	191.74	208.43	158.65	103.86	33.23	68.39	1,332.46	111.04		
	Ratio[b]	0.13	0.20	0.46	0.82	1.45	**2.06**	1.73	1.88	1.43	0.94	0.30	0.62			2.06	0.13
1999	Use	15.00	55.38	64.71	143.92	204.23	190.64	332.49	183.97	188.02	146.19	100.79	136.37	1,761.71	146.81		
	Ratio[b]	0.10	0.38	0.44	0.98	1.39	1.30	**2.26**	1.25	1.28	1.00	0.69	0.93			2.26	0.10
Average	Simple	0.17	0.22	0.43	0.86	1.38	1.76	1.82	1.74	1.52	1.11	0.47	0.51	1,358.37	113.20	2.10	0.11
	Adjusted[d]	0.11	0.16	0.37	0.82	1.37	1.83	2.10	1.76	1.51	1.09	0.42	0.46			2.10	0.11

a) Based on actual CMWD metered demands.

b) Annual monthly demand variation expressed as a ratio of actual monthly demand divided by the average monthly demand for that year.

c) Demand factors include peak-to-average (P/A) month and minimum-to-average (M/A) month.

d) See report text for explanation.

Appendix B

SEASONAL STORAGE MODEL RUNS

Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 1A: With Full Seasonal Storage
SUPPLY: RW=1.61 mgd; Other=0 mgd
DEMAND: Current @ 1,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 548 ac-ft required seasonal storage

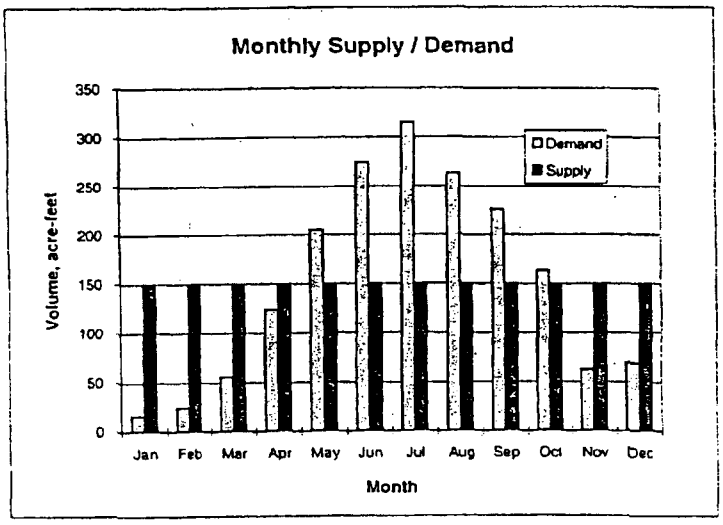
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	16	0	16	150	0	150	134	302	79
Feb	n/a	n/a	0.16	24	0	24	150	0	150	126	427	79
Mar	n/a	n/a	0.37	56	0	56	150	0	150	94	521	79
Apr	n/a	n/a	0.82	123	0	123	150	0	150	27	548	79
May	n/a	n/a	1.37	205	0	205	150	0	150	(55)	493	79
Jun	n/a	n/a	1.83	275	0	275	150	0	150	(125)	368	79
Jul	**n/a**	**n/a**	**2.10**	**315**	**0**	**315**	**150**	**0**	**150**	**(165)**	**203**	**79**
Aug	n/a	n/a	1.76	264	0	264	150	0	150	(114)	89	79
Sep	n/a	n/a	1.51	226	0	226	150	0	150	(76)	13	79
Oct	n/a	n/a	1.09	163	0	163	150	0	150	(13)	0	79
Nov	n/a	n/a	0.42	63	0	63	150	0	150	87	87	79
Dec	n/a	n/a	0.46	70	0	70	150	0	150	80	168	79
TOTAL	n/a	n/a	12.00	1,800	0	1,800	1,800	0	1,800	0		946

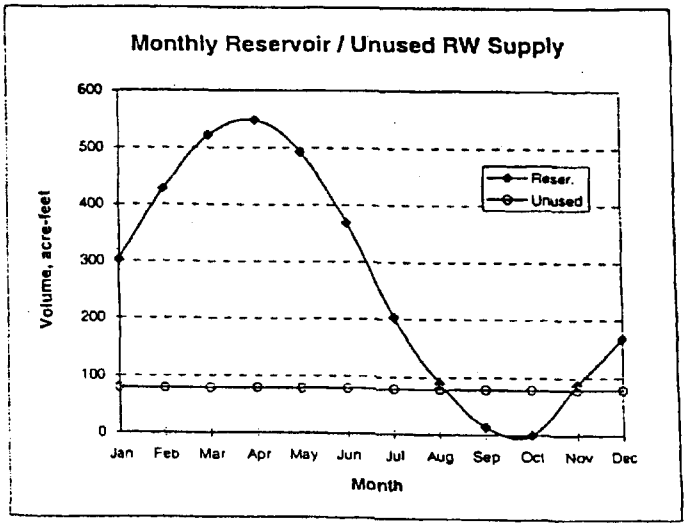
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 1,800 = annual project irrigation demand (ac-ft/yr)
d) 2.45 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 3.00 = maximum reservoir inflow allowed (mgd)
3.00 = maximum reservoir outflow allowed (mgd)
g) 1,000 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 1,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 1.61 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 1.43 = maximum reservoir inflow used (mgd)
10) 1.77 = maximum reservoir outflow used (mgd)
11) 548 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 1B: With No Seasonal Storage
SUPPLY: RW=2.45 mgd; Other=0.92 mgd
DEMAND: Current @ 1,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 0 ac-ft required seasonal storage

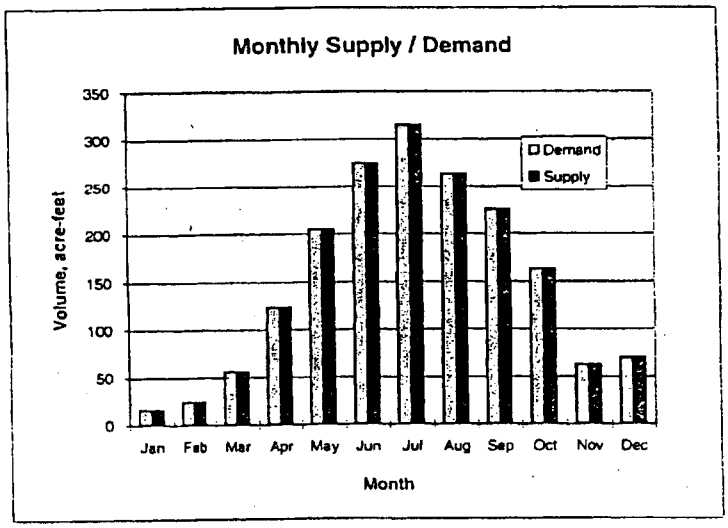
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	16	0	16	16	0	16	0	0	213
Feb	n/a	n/a	0.16	24	0	24	24	0	24	0	0	204
Mar	n/a	n/a	0.37	56	0	56	56	0	56	0	0	173
Apr	n/a	n/a	0.82	123	0	123	123	0	123	0	0	105
May	n/a	n/a	1.37	205	0	205	205	0	205	0	0	24
Jun	n/a	n/a	1.83	275	0	275	229	46	275	0	0	0
Jul	**n/a**	**n/a**	**2.10**	**315**	**0**	**315**	**229**	**86**	**315**	**(0)**	**(0)**	**0**
Aug	n/a	n/a	1.76	264	0	264	229	35	264	0	(0)	0
Sep	n/a	n/a	1.51	226	0	226	226	0	226	0	(0)	3
Oct	n/a	n/a	1.09	163	0	163	163	0	163	0	0	65
Nov	n/a	n/a	0.42	63	0	63	63	0	63	0	0	166
Dec	n/a	n/a	0.46	70	0	70	70	0	70	0	0	159
TOTAL	n/a	n/a	12.00	1,800	0	1,800	1,633	167	1,800	(0)		1,113

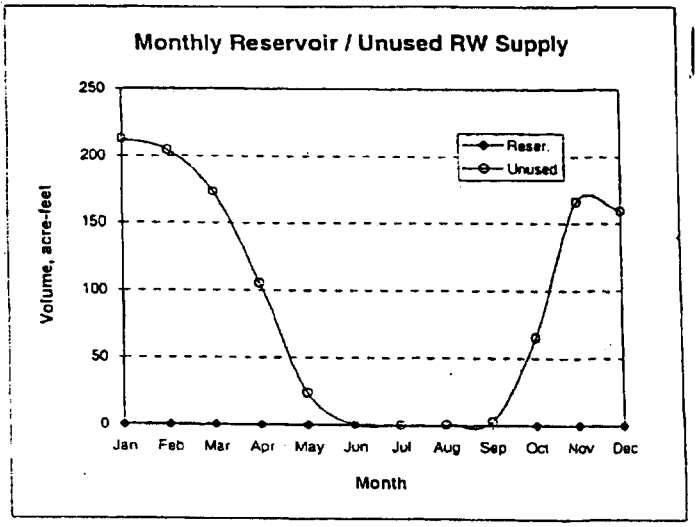
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 1,800 = annual project irrigation demand (ac-ft/yr)
d) 2.45 = maximum recycled water supply available (mgd)
e) 1.00 = maximum other water supply available (mgd)
f) 0.00 = maximum reservoir inflow allowed (mgd)
0.00 = maximum reservoir outflow allowed (mgd)
g) 0 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 1,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 2.45 = maximum RW supply used (mgd)
8) 0.92 = maximum other supply used (mgd)
9) 0.00 = maximum reservoir inflow used (mgd)
10) 0.00 = maximum reservoir outflow used (mgd)
11) 0 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 1C: With Mahr Reservoir Seasonal Storage
SUPPLY: RW=2.45 mgd; Other=0.17 mgd
DEMAND: Current @ 1,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

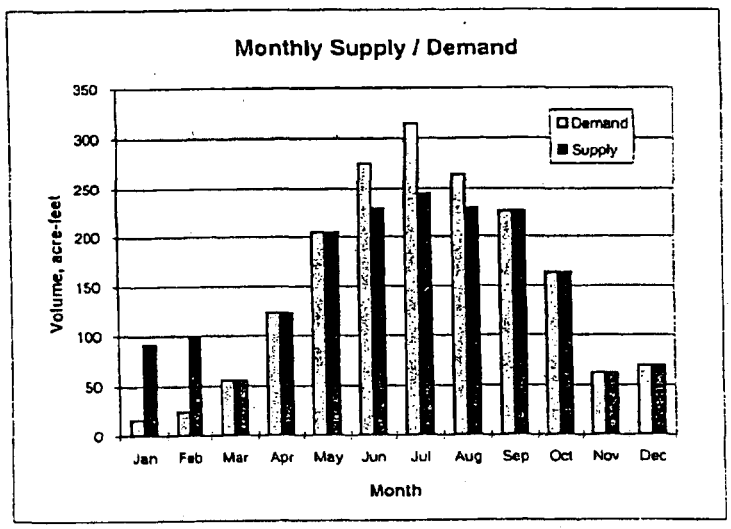
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	16	0	16	92	0	92	76	76	137
Feb	n/a	n/a	0.16	24	0	24	100	0	100	76	151	129
Mar	n/a	n/a	0.37	56	0	56	56	0	56	0	151	173
Apr	n/a	n/a	0.82	123	0	123	123	0	123	0	151	105
May	n/a	n/a	1.37	205	0	205	205	0	205	0	151	24
Jun	n/a	n/a	1.83	275	0	275	229	0	229	(46)	105	0
Jul	**n/a**	**n/a**	**2.10**	**315**	**0**	**315**	**229**	**16**	**245**	**(70)**	**35**	**0**
Aug	n/a	n/a	1.76	264	0	264	229	0	229	(35)	0	0
Sep	n/a	n/a	1.51	226	0	226	226	0	226	0	0	3
Oct	n/a	n/a	1.09	163	0	163	163	0	163	0	0	65
Nov	n/a	n/a	0.42	63	0	63	63	0	63	0	0	166
Dec	n/a	n/a	0.46	70	0	70	70	0	70	0	0	159
TOTAL	n/a	n/a	12.00	1,800	0	1,800	1,784	16	1,800	(0)		962

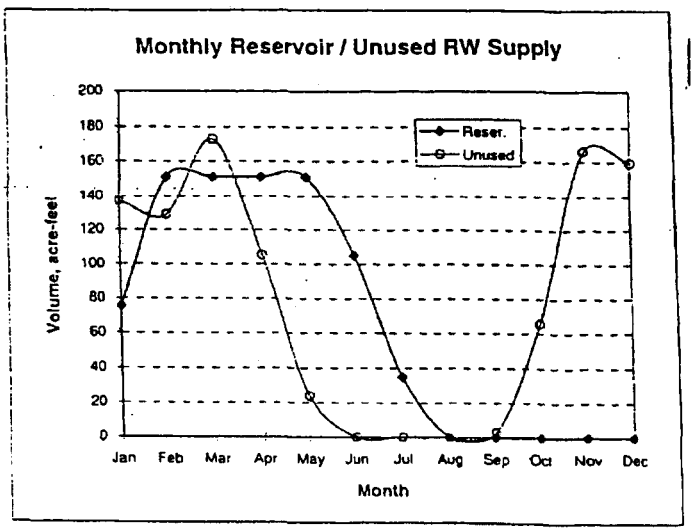
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 1,800 = annual project irrigation demand (ac-ft/yr)
d) 2.45 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 3.00 = maximum reservoir inflow allowed (mgd)
3.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 1,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 2.45 = maximum RW supply used (mgd)
8) 0.17 = maximum other supply used (mgd)
9) 0.81 = maximum reservoir inflow used (mgd)
10) 0.75 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2A: With Full Seasonal Storage
SUPPLY: RW=4.82 mgd; Other=0 mgd
DEMAND: Phase II @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 1,644 ac-ft required seasonal storage

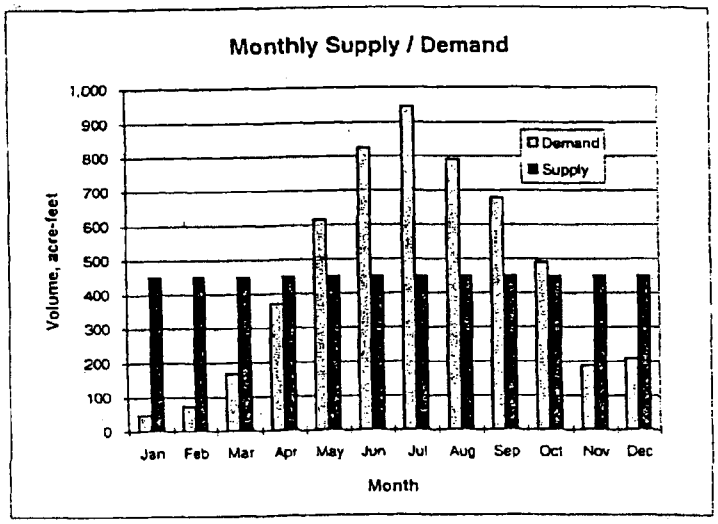
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	450	0	450	401	905	297
Feb	n/a	n/a	0.16	73	0	73	450	0	450	377	1,282	297
Mar	n/a	n/a	0.37	168	0	168	450	0	450	282	1,564	297
Apr	n/a	n/a	0.82	370	0	370	450	0	450	80	1,644	297
May	n/a	n/a	1.37	615	0	615	450	0	450	(165)	1,479	297
Jun	n/a	n/a	1.83	824	0	824	450	0	450	(374)	1,104	297
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**450**	**0**	**450**	**(495)**	**609**	**297**
Aug	n/a	n/a	1.76	791	0	791	450	0	450	(341)	268	297
Sep	n/a	n/a	1.51	678	0	678	450	0	450	(228)	40	297
Oct	n/a	n/a	1.09	490	0	490	450	0	450	(40)	0	297
Nov	n/a	n/a	0.42	188	0	188	450	0	450	262	262	297
Dec	n/a	n/a	0.46	209	0	209	450	0	450	241	503	297
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,400	0	5,400	(0)		3,565

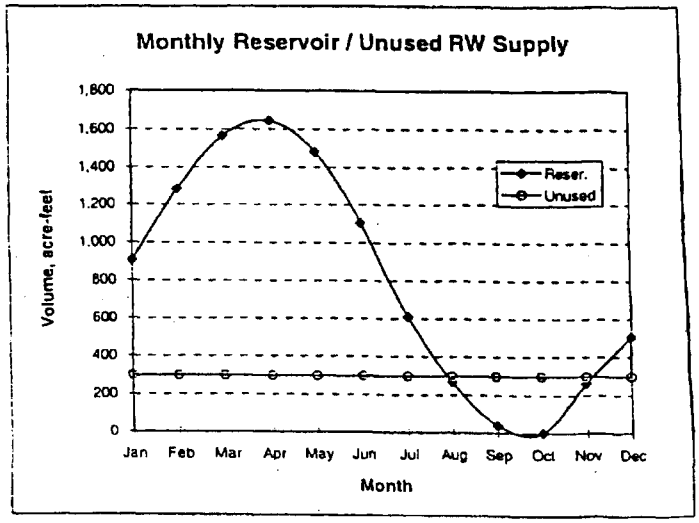
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 2,000 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 4.82 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 4.30 = maximum reservoir inflow used (mgd)
10) 5.30 = maximum reservoir outflow used (mgd)
11) 1,644 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2B: With No Seasonal Storage
SUPPLY: RW=8.00 mgd; Other=2.12 mgd
DEMAND: Phase II @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 0 ac-ft required seasonal storage

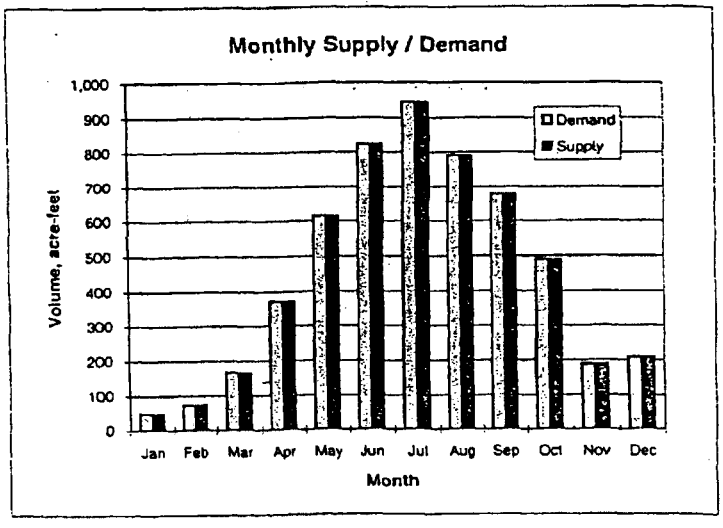
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [a]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	49	0	49	0	0	699
Feb	n/a	n/a	0.16	73	0	73	73	0	73	0	0	674
Mar	n/a	n/a	0.37	168	0	168	168	0	168	0	0	579
Apr	n/a	n/a	0.82	370	0	370	370	0	370	0	0	377
May	n/a	n/a	1.37	615	0	615	615	0	615	0	0	132
Jun	n/a	n/a	1.83	824	0	824	747	77	824	(0)	(0)	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**198**	**945**	**(0)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,081	319	5,400	(0)		3,885

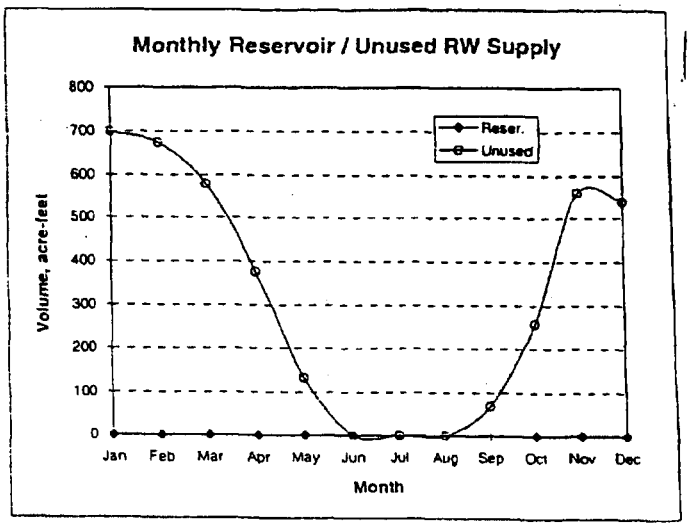
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 0.00 = maximum reservoir inflow allowed (mgd)
0.00 = maximum reservoir outflow allowed (mgd)
g) 0 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 2.12 = maximum other supply used (mgd)
9) 0.00 = maximum reservoir inflow used (mgd)
10) 0.00 = maximum reservoir outflow used (mgd)
11) 0 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2C: With Mahr Reservoir Seasonal Storage
SUPPLY: RW=8.00 mgd; Other=0.66 mgd
DEMAND: Phase II @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

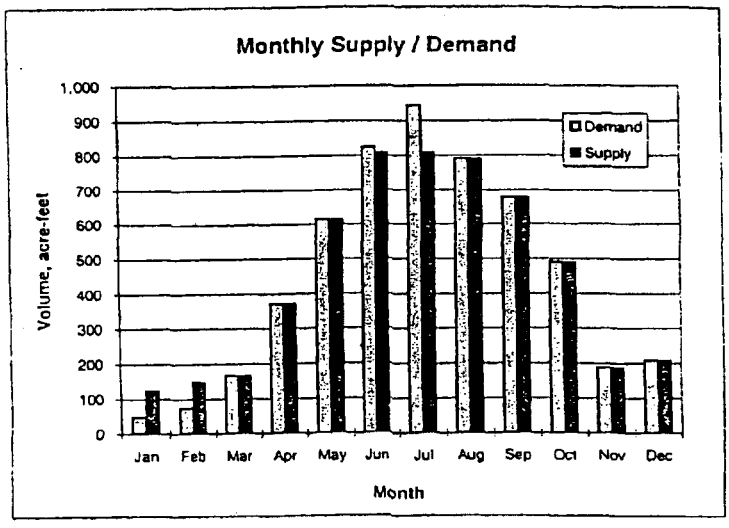
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [a]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	149	0	149	76	151	598
Mar	n/a	n/a	0.37	168	0	168	168	0	168	0	151	579
Apr	n/a	n/a	0.82	370	0	370	370	0	370	0	151	377
May	n/a	n/a	1.37	615	0	615	615	0	615	0	151	132
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	0	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	0	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	(0)		3,734

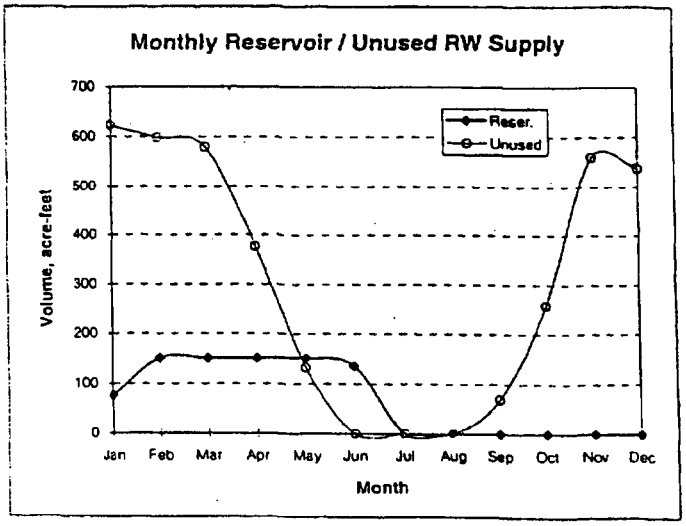
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 0.81 = maximum reservoir inflow used (mgd)
10) 1.46 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 3A: With Full Seasonal Storage
SUPPLY: RW=8.74 mgd; Other=0 mgd
DEMAND: Ultimate @ 9,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 2,983 ac-ft required seasonal storage

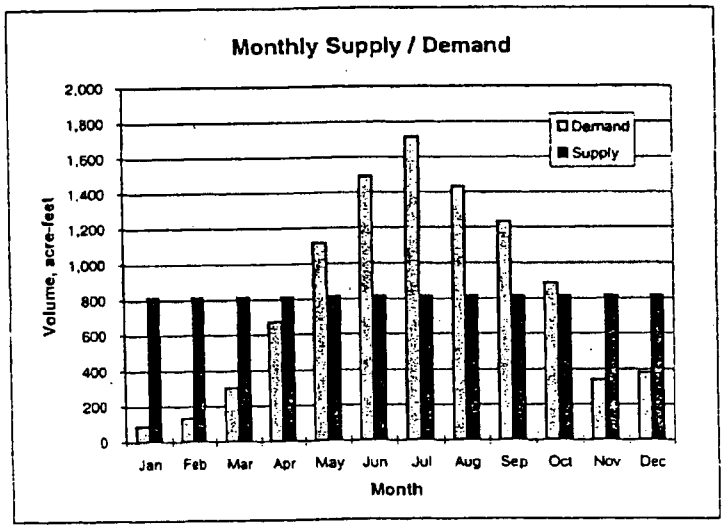
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	88	0	88	817	0	817	729	1,642	1,051
Feb	n/a	n/a	0.16	133	0	133	817	0	817	684	2,326	1,051
Mar	n/a	n/a	0.37	304	0	304	817	0	817	512	2,838	1,051
Apr	n/a	n/a	0.82	672	0	672	817	0	817	145	2,983	1,051
May	n/a	n/a	1.37	1,116	0	1,116	817	0	817	(299)	2,683	1,051
Jun	n/a	n/a	1.83	1,496	0	1,496	817	0	817	(679)	2,004	1,051
Jul	**n/a**	**n/a**	**2.10**	**1,716**	**0**	**1,716**	**817**	**0**	**817**	**(899)**	**1,105**	**1,051**
Aug	n/a	n/a	1.76	1,436	0	1,436	817	0	817	(619)	486	1,051
Sep	n/a	n/a	1.51	1,230	0	1,230	817	0	817	(414)	73	1,051
Oct	n/a	n/a	1.09	889	0	889	817	0	817	(73)	0	1,051
Nov	n/a	n/a	0.42	341	0	341	817	0	817	476	476	1,051
Dec	n/a	n/a	0.46	379	0	379	817	0	817	438	914	1,051
TOTAL	n/a	n/a	12.00	9,800	0	9,800	9,800	0	9,800	0		12,613

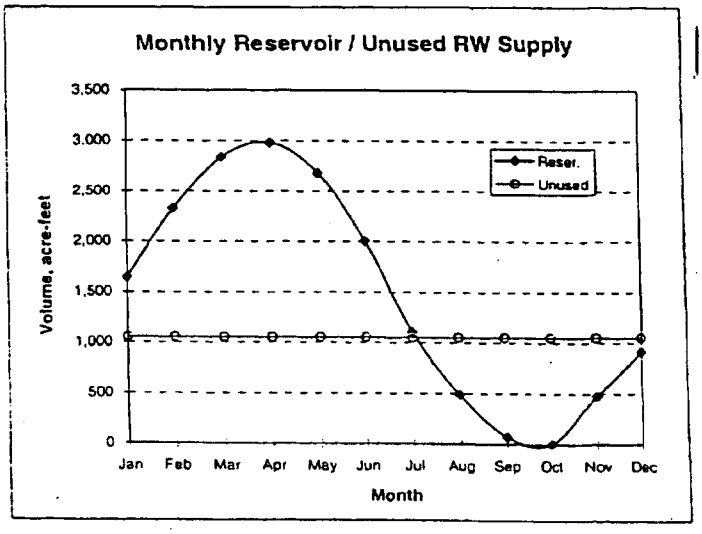
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 9,800 = annual project irrigation demand (ac-ft/yr)
d) 20.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 12.00 = maximum reservoir inflow allowed (mgd)
12.00 = maximum reservoir outflow allowed (mgd)
g) 3,000 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 9,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.74 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 7.80 = maximum reservoir inflow used (mgd)
10) 9.63 = maximum reservoir outflow used (mgd)
11) 2,983 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 3B: With No Seasonal Storage
SUPPLY: RW=18.37 mgd; Other=0 mgd
DEMAND: Ultimate @ 9,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 0 ac-ft required seasonal storage

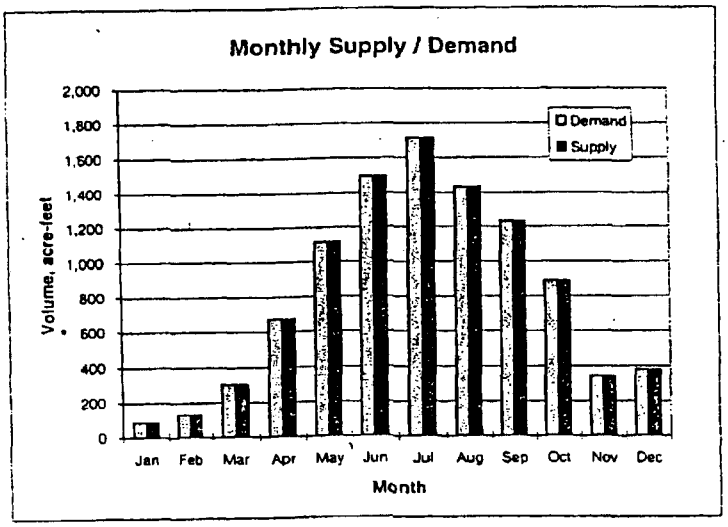
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [a]	Other Supply, ac-ft [b]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	88	0	88	88	0	88	0	0	1,780
Feb	n/a	n/a	0.16	133	0	133	133	0	133	0	0	1,735
Mar	n/a	n/a	0.37	304	0	304	304	0	304	0	0	1,563
Apr	n/a	n/a	0.82	672	0	672	672	0	672	0	0	1,196
May	n/a	n/a	1.37	1,116	0	1,116	1,116	0	1,116	0	0	752
Jun	n/a	n/a	1.83	1,496	0	1,496	1,496	0	1,496	0	0	372
Jul	**n/a**	**n/a**	**2.10**	**1,716**	**0**	**1,716**	**1,716**	**0**	**1,716**	**0**	**0**	**152**
Aug	n/a	n/a	1.76	1,436	0	1,436	1,436	0	1,436	0	0	432
Sep	n/a	n/a	1.51	1,230	0	1,230	1,230	0	1,230	0	0	638
Oct	n/a	n/a	1.09	889	0	889	889	0	889	0	0	979
Nov	n/a	n/a	0.42	341	0	341	341	0	341	0	0	1,527
Dec	n/a	n/a	0.46	379	0	379	379	0	379	0	0	1,489
TOTAL	n/a	n/a	12.00	9,800	0	9,800	9,800	0	9,800	0		12,613

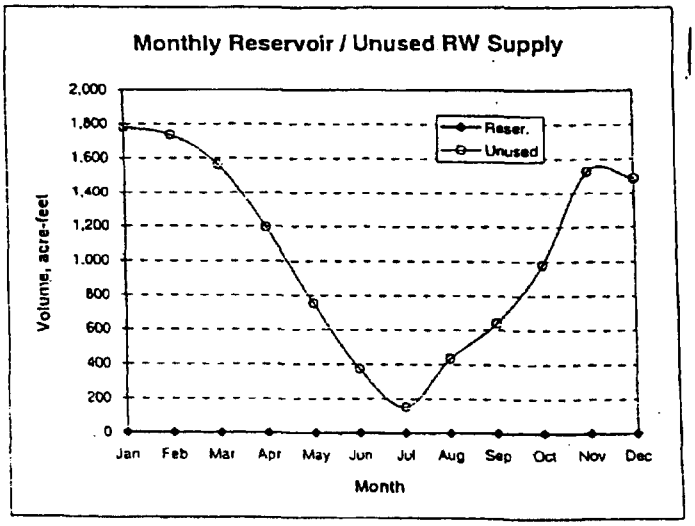
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 9,800 = annual project irrigation demand (ac-ft/yr)
d) 20.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 0.00 = maximum reservoir inflow allowed (mgd)
0.00 = maximum reservoir outflow allowed (mgd)
g) 0 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 9,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 18.37 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 0.00 = maximum reservoir inflow used (mgd)
10) 0.00 = maximum reservoir outflow used (mgd)
11) 0 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 3C: With Mahr Reservoir Seasonal Storage
SUPPLY: RW=16.76 mgd; Other=0 mgd
DEMAND: Ultimate @ 9,800 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

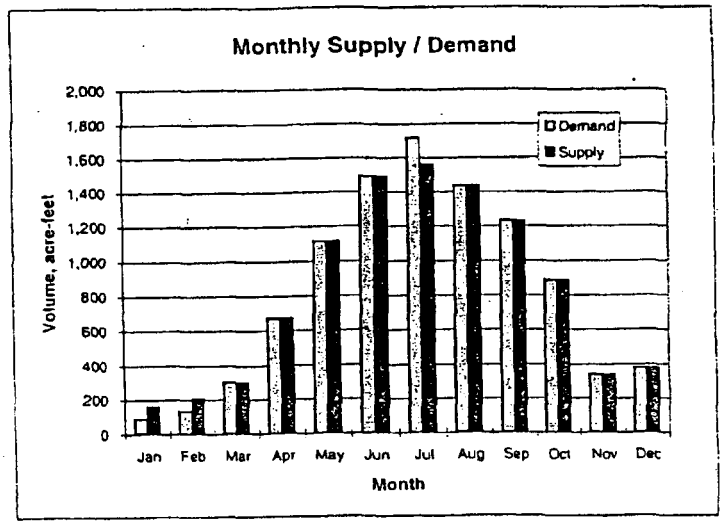
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	88	0	88	164	0	164	76	76	1,704
Feb	n/a	n/a	0.16	133	0	133	208	0	208	76	151	1,659
Mar	n/a	n/a	0.37	304	0	304	304	0	304	0	151	1,563
Apr	n/a	n/a	0.82	672	0	672	672	0	672	0	151	1,196
May	n/a	n/a	1.37	1,116	0	1,116	1,116	0	1,116	0	151	752
Jun	n/a	n/a	1.83	1,496	0	1,496	1,496	0	1,496	0	151	372
Jul	**n/a**	**n/a**	**2.10**	**1,716**	**0**	**1,716**	**1,565**	**0**	**1,565**	**(151)**	**0**	**303**
Aug	n/a	n/a	1.76	1,436	0	1,436	1,436	0	1,436	0	0	432
Sep	n/a	n/a	1.51	1,230	0	1,230	1,230	0	1,230	0	0	638
Oct	n/a	n/a	1.09	889	0	889	889	0	889	0	0	979
Nov	n/a	n/a	0.42	341	0	341	341	0	341	0	0	1,527
Dec	n/a	n/a	0.46	379	0	379	379	0	379	0	0	1,489
TOTAL	n/a	n/a	12.00	9,800	0	9,800	9,800	0	9,800	0		12,613

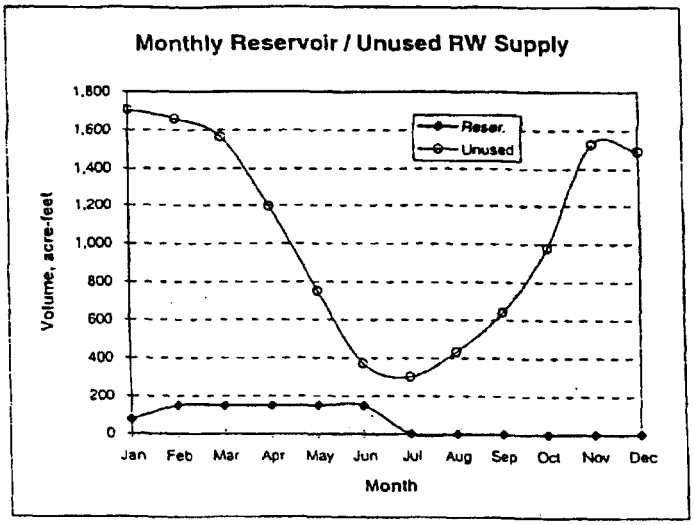
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 9,800 = annual project irrigation demand (ac-ft/yr)
d) 20.00 = maximum recycled water supply available (mgd)
e) 0.00 = maximum other water supply available (mgd)
f) 3.00 = maximum reservoir inflow allowed (mgd)
3.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 9,800 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 16.76 = maximum RW supply used (mgd)
8) 0.00 = maximum other supply used (mgd)
9) 0.81 = maximum reservoir inflow used (mgd)
10) 1.61 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Appendix C

EMERGENCY STORAGE MODEL RUNS

Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2D: With Mahr Reservoir Seasonal and Emergency Storage
SUPPLY: RW=8.00 mgd with loss of 149 ac-ft in February; Other=0.66 mgd
DEMAND: Current @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

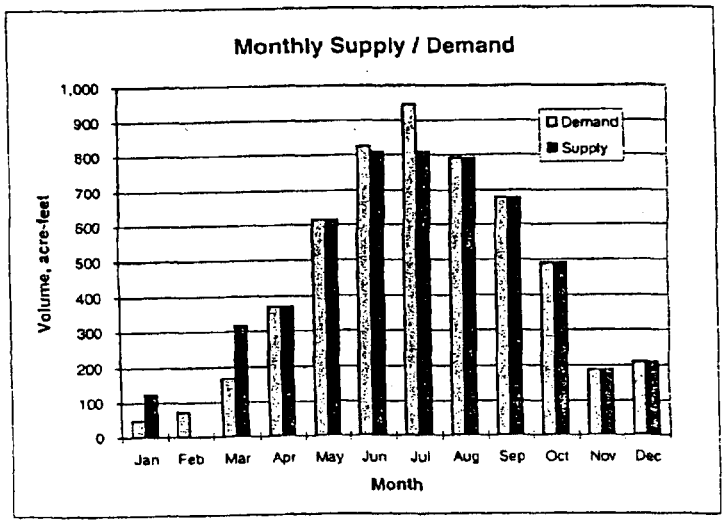
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [b]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	0	0	0	(73)	2	747
Mar	n/a	n/a	0.37	168	0	168	317	0	317	149	151	430
Apr	n/a	n/a	0.82	370	0	370	370	0	370	0	151	377
May	n/a	n/a	1.37	615	0	615	615	0	615	0	151	132
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	0		3,733

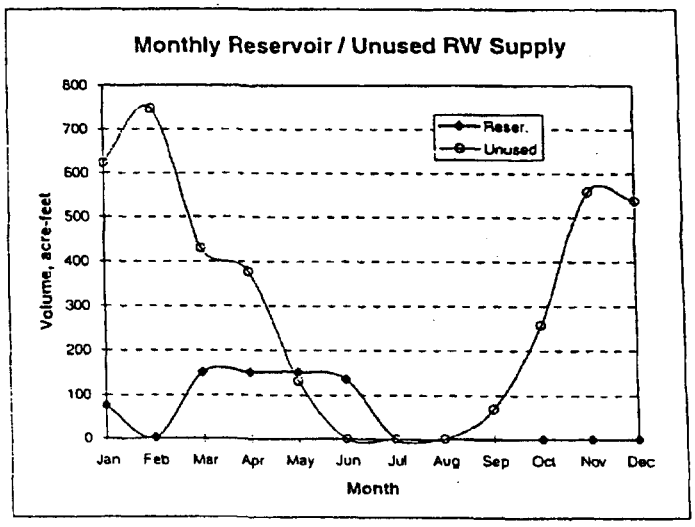
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 1.60 = maximum reservoir inflow used (mgd)
10) 1.46 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2D: *With Mahr Reservoir Seasonal and Emergency Storage*
SUPPLY: RW=8.00 mgd with loss of 151 ac-ft in March; Other=0.66 mgd
DEMAND: Current @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

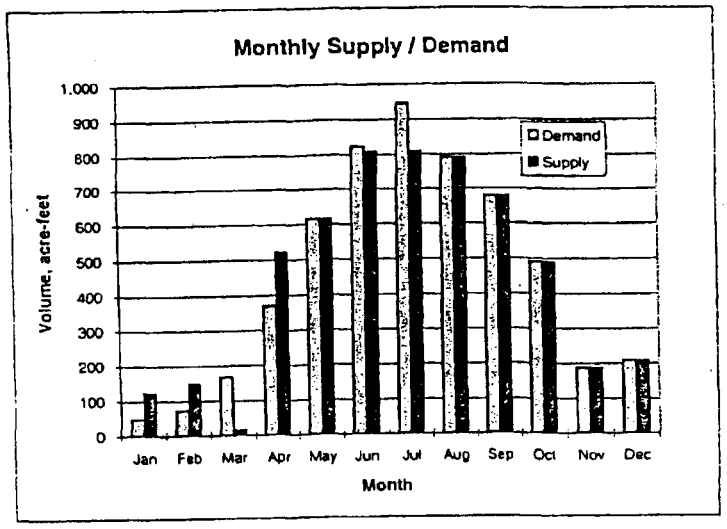
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	149	0	149	76	151	598
Mar	n/a	n/a	0.37	168	0	168	17	0	17	(151)	0	730
Apr	n/a	n/a	0.82	370	0	370	521	0	521	151	151	226
May	n/a	n/a	1.37	615	0	615	615	0	615	0	151	132
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	(0)		3,734

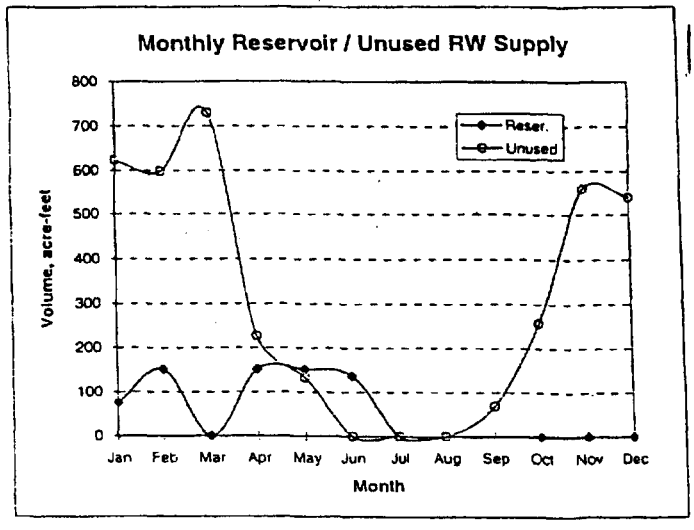
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 1.61 = maximum reservoir inflow used (mgd)
10) 1.61 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





Analysis of Monthly Supply/Demand/Storage Requirements

PROJECT: CMWD Recycled Water System Expansion
SCENARIO 2D: With Mahr Reservoir Seasonal and Emergency Storage
SUPPLY: RW=8.00 mgd with loss of 131 ac-ft in April; Other=0.66 mgd
DEMAND: Current @ 5,400 ac-ft/yr
STORAGE: 0 ac-ft existing seasonal storage, 151 ac-ft required seasonal storage

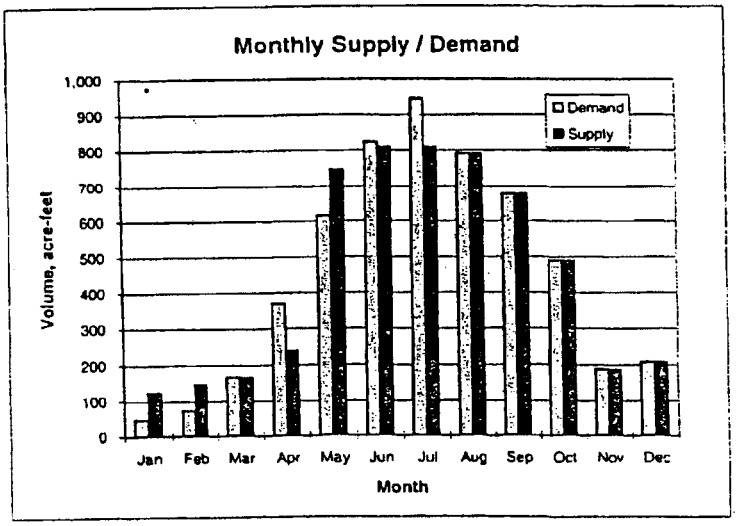
Month	Evapo-transpir., in	Precip., in	Seasonal Variation Ratio	Project Demand, ac-ft [c]	Other Demand, ac-ft	Total Demand, ac-ft	RW Supply, ac-ft [d]	Other Supply, ac-ft [e]	Total Supply, ac-ft	Reser. Flow, ac-ft [f]	Reser. Storage, ac-ft [g]	Unused RW Supp., ac-ft
Jan	n/a	n/a	0.11	49	0	49	124	0	124	76	76	623
Feb	n/a	n/a	0.16	73	0	73	149	0	149	76	151	598
Mar	n/a	n/a	0.37	168	0	168	168	0	168	0	151	579
Apr	n/a	n/a	0.82	370	0	370	239	0	239	(131)	20	508
May	n/a	n/a	1.37	615	0	615	747	0	747	132	151	0
Jun	n/a	n/a	1.83	824	0	824	747	62	809	(15)	136	0
Jul	**n/a**	**n/a**	**2.10**	**945**	**0**	**945**	**747**	**62**	**809**	**(136)**	**(0)**	**0**
Aug	n/a	n/a	1.76	791	0	791	747	44	791	0	(0)	0
Sep	n/a	n/a	1.51	678	0	678	678	0	678	0	(0)	69
Oct	n/a	n/a	1.09	490	0	490	490	0	490	0	0	257
Nov	n/a	n/a	0.42	188	0	188	188	0	188	0	0	559
Dec	n/a	n/a	0.46	209	0	209	209	0	209	0	0	538
TOTAL	n/a	n/a	12.00	5,400	0	5,400	5,232	168	5,400	0		3,733

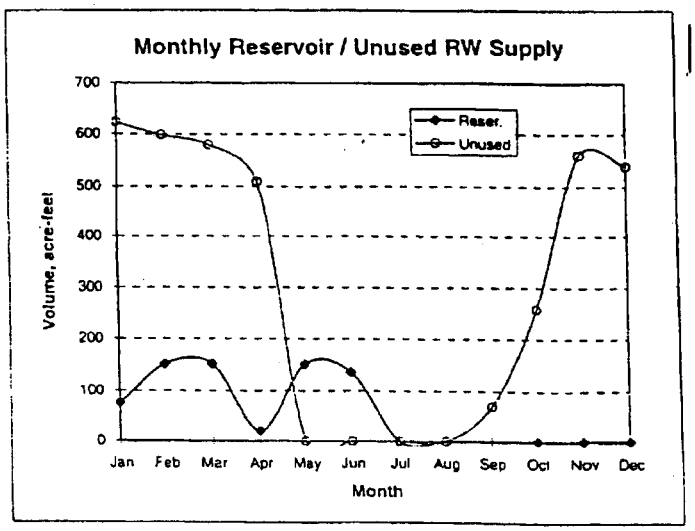
INPUT

a) n/a = effective/total precipitation ratio (no units)
b) n/a = irrigation efficiency (no units)
c) 5,400 = annual project irrigation demand (ac-ft/yr)
d) 8.00 = maximum recycled water supply available (mgd)
e) 2.00 = maximum other water supply available (mgd)
f) 8.00 = maximum reservoir inflow allowed (mgd)
8.00 = maximum reservoir outflow allowed (mgd)
g) 151 = maximum reservoir working storage available (ac-ft)

OUTPUT

1) 2.10 = peak month factor (no units)
2) n/a = irrigation application rate (ft/yr)
3) 5,400 = annual total demand (ac-ft/yr)
4) 1.00 = total supply/demand ratio (no units)
5) **Jul = maximum irrigation demand month**
6) Jan = minimum irrigation demand month
7) 8.00 = maximum RW supply used (mgd)
8) 0.66 = maximum other supply used (mgd)
9) 1.41 = maximum reservoir inflow used (mgd)
10) 1.46 = maximum reservoir outflow used (mgd)
11) 151 = maximum reservoir working storage used (ac-ft)





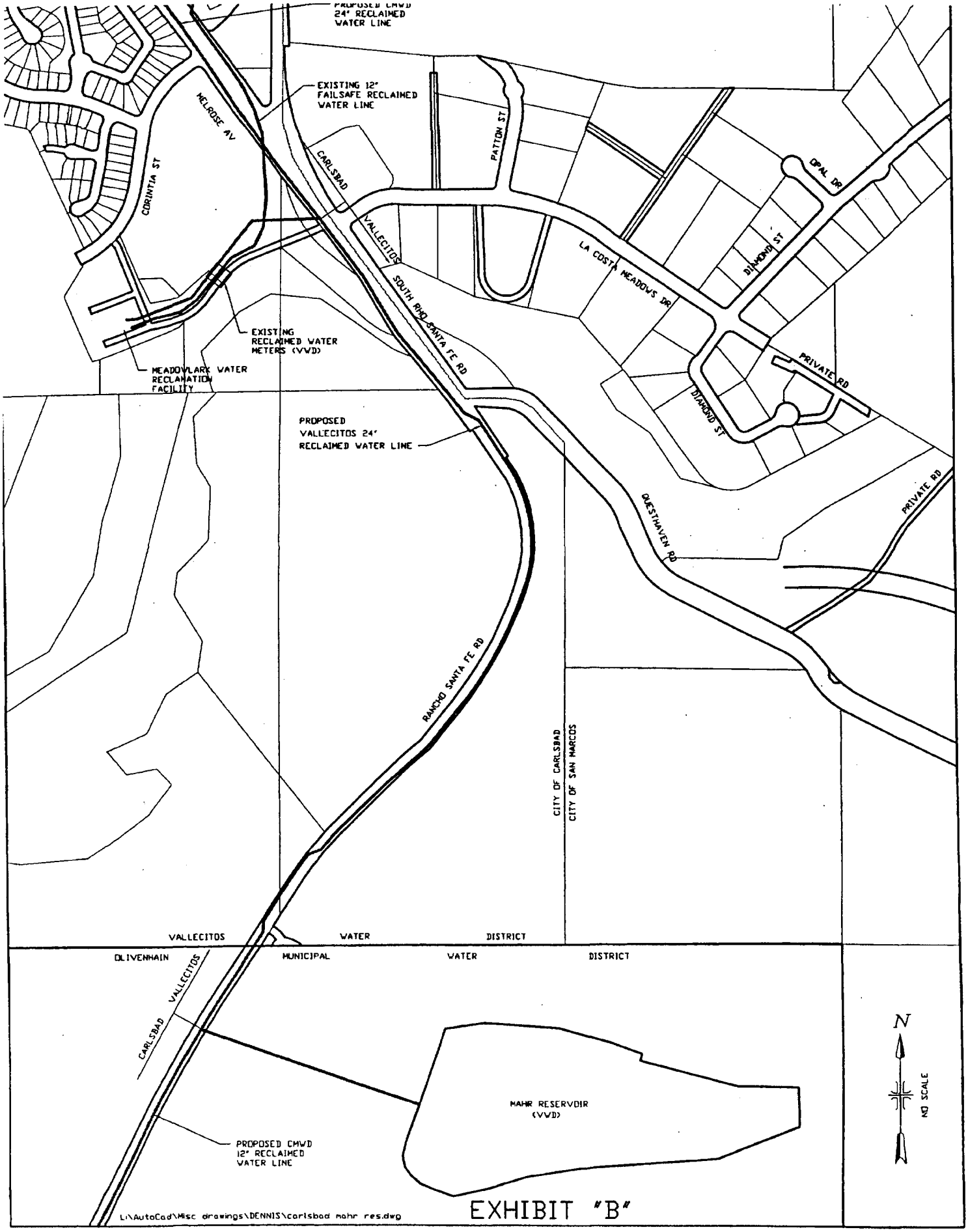

PROPOSED CMWD
24" RECLAIMED
WATER LINE
EXISTING 12"
FAILSAFE RECLAIMED
WATER LINE
MELROSE AV
CORINTIA ST
CARLSBAD
PATTON ST
OPAL DR
VALLECITOS
LA COSTA MEADOWS DR
DIAMOND ST
SOUTH RANCHO SANTA FE RD
EXISTING
RECLAIMED WATER
METERS (VWD)
MEADOWLARK WATER
RECLAMATION
FACILITY
PRIVATE RD
PROPOSED
VALLECITOS 24"
RECLAIMED WATER LINE
QUESTHAVEN RD
RANCHO SANTA FE RD
CITY OF CARLSBAD
CITY OF SAN MARCOS
VALLECITOS
WATER
DISTRICT
OLIVENHAIN
MUNICIPAL
WATER
DISTRICT
CARLSBAD
VALLECITOS
MAHR RESERVOIR
(VWD)
PROPOSED CMWD
12" RECLAIMED
WATER LINE
N
NO SCALE
L:\AutoCad\Misc drawings\DENNIS\carlsbad mahr res.dwg
EXHIBIT "B"

EXHIBIT C
Method of Calculating Recycled Water Rate

Pre-Expansion Annual Cost (1)	FY 2002/03 Budget	Allocated to MRF Tertiary Facilities Percent	Amount
MRF Plant Costs			
Labor	$ 210,000	25.0%	$ 52,500
Materials	740,000	9.6%	71,040
Power	225,000	25.0%	56,250
Other operating costs	43,000	50.0%	21,500
Lift Station No. 1	60,000	100.0%	60,000
Mahr Reservoir	17,000	100.0%	17,000
Capital Recovery			110,926
Overhead – Wastewater Department	$ 445,000	9.0%	40,050
Overhead – District Wide	3,658,000	1.9%	69,502
Total Annual Costs to Recover			498,138
Quarterly Payments		+	4
Total Quarterly Payment due to VALLECITOS			$ 124,535

Post-Expansion Annual Cost (1)	Original or Actual Costs	Anticipated Post-Expansion Annual Costs	Allocated to MRF Tertiary Facilities Percent	Amount
MRF Plant Costs (2)				
Labor		$ 329,000	25.0%	$ 82,250
Materials		237,000	9.6%	22,752
Power		539,000	25.0%	134,750
Other operating costs		90,000	50.0%	45,000
Lift Station No. 1		126,000	100.0%	126,000
Mahr Reservoir		15,000	100.0%	15,000
Overhead – Wastewater Department		500,851	9.0%	45,077
Overhead – District Wide		4,117,111	1.9%	78,225
Capital Recovery (3)				
Existing filtration plant	$ 613,821	53,516	100.0%	53,516
Existing disinfection facility	158,041	13,779	100.0%	13,779
Existing effluent pumping station	155,602	13,566	100.0%	13,566
Existing microscreen	219,841	19,167	100.0%	19,167
Existing Mahr Reservoir (4)	125,000	6,975	100.0%	10,898
Expansion design costs	204,923	17,866	100.0%	17,866
Expansion of filtration plant	977,000	85,179	100.0%	85,179
Expansion of disinfection facility	336,000	29,294	100.0%	29,294
Total Annual Costs to Recover				792,319
Number of months per year			÷	12
Total Monthly Payment due to VALLECITOS				$ 66,027

)tes:

Annual costs shall be set each year based on budgeted amounts and retrospectively adjusted to audited amounts after year-end as described in Section 13 of the agreement.

MRF Plant Costs – Operating costs for labor, materials, power, "other operating costs", Lift Station No. 1, Mahr Reservoir and overhead will be reviewed at year-end and adjusted to reflect actual costs. For Capital Recovery the costs will be specifically identified as to primary, secondary, and tertiary treatment. (i.e., 0% will be allocated to MRF Tertiary for costs specifically identified to primary and secondary treatment while 100% of tertiary treatment costs will be allocated to MRF Tertiary. "Other operating costs" include miscellaneous items such as telemetry, telephone lines, minor repairs, etc.

Vallecitos' actual costs of expansion design; filtration plant and disinfection facilities shall be used, when calculating capital recovery. Vallecitos' cost of subsequent replacement of MRF tertiary facilities will replace original costs used for calculating capital recovery. Existing facilities no longer needed for tertiary processes will be eliminated from the capital recovery calculation. Capital recovery shall be calculated based on an engineering economic formula using a uniform series capital recovery factor with a compound interest of six (6) percent, and a twenty-year life.

Mahr Reservoir value is based upon the existing inlet/outlet piping through the reservoir, leakage recovery piping, and fencing, access road and overflow facilities only. The existing dam drainage pump back system and inlet/outlet facilities will be replaced with new facilities identified in Exhibit "B".

AGREEMENT BETWEEN THE CITY OF CARLSBAD, CARLSBAD MUNICIPAL WATER DISTRICT, AND THE VALLECITOS WATER DISTRICT FOR THE CONSTRUCTION AND RECONSTRUCTION OF RECYCLED WATER LINES AND RELATED STRUCTURES, RANCHO SANTA FE ROAD NORTH, PHASE 1, PROJECT NOS. 3190 AND 3887

THIS AGREEMENT, made and entered into as of the 19th day of February, 2004, by and between the CITY OF CARLSBAD, a municipal corporation, hereinafter referred to as "CARLSBAD", CARLSBAD MUNICIPAL WATER DISTRICT, a municipal corporation, hereinafter referred to as "CMWD", and VALLECITOS WATER DISTRICT, a County Water District, hereinafter referred to as "DISTRICT", (collectively the "Parties").

RECITALS

WHEREAS, CARLSBAD desires to realign and widen Rancho Santa Fe Road ("ROAD") in the Canyon Alignment as directed by the City Council at their meeting of October 20, 1987; and

WHEREAS, the ROAD is integral to the traffic circulation element plans for CARLSBAD and the North County Region in general; and

WHEREAS, the realigned and widened ROAD will conflict with an existing DISTRICT 12" recycled water pipeline; and

WHEREAS, DISTRICT desires to realign the existing 12" recycled water pipeline within the alignment of the ROAD; and

WHEREAS, CMWD desires to increase the size of the DISTRICT's existing 12" recycled water pipeline to 24" and construct a 30" recycled water pipeline for the purpose of CMWD's Phase II Recycled Water Program; and

WHEREAS, CARLSBAD, CMWD and DISTRICT desire to establish mutually agreed upon responsibilities for the funding, design, and construction for relocation of the DISTRICT facilities impacted by the realignment and widening of the ROAD.

NOW, THEREFORE, in consideration of the above recitals, CARLSBAD, CMWD and DISTRICT do hereby mutually agree as follows:

I. RANCHO SANTA FE ROAD REALIGNMENT:

A. PROJECT DESCRIPTION

Rancho Santa Fe Road North, Phase 1 ("PROJECT") involves the relocation and widening of the existing Road from southerly of La Costa Avenue northward for approximately I ¾ miles, as shown on Exhibit "A", attached hereto and made a part hereof. The PROJECT involves grading of the roadbed to full prime arterial road width of 126 feet with construction of improvements including six traveled lanes, two 8-foot shoulders, with outside curb and gutters and sidewalks, plus improved median.

The ROAD crosses the existing recycled water pipeline in two locations. The profile of the ROAD is such that additional fill would be required on the existing recycled water pipeline. The existing recycled water pipeline is not designed to handle the existing loading that would result from the additional fill. Both crossings are in areas where the DISTRICT has senior rights.

CMWD will upsize the DISTRICT's 12" recycled water pipeline to 24" for the purposes of utilizing Mahr Reservoir to provide seasonal storage for the Phase II Recycled Water Program. The maintenance, operation and capacity rights of the upsizing of this pipeline is discussed in a separate agreement between CMWD and DISTRICT.

B. CARLSBAD AGREES:

1. To act as lead agency for the purpose of design and environmental review and to provide all labor, materials, tools and equipment for PROJECT. As lead agency CARLSBAD will handle permit acquisition, advertising, award, contract administration, Resident Engineer, material source inspection, independent assurance and specialty testing, and such other construction engineering as may be required, for satisfactory completion of PROJECT.

2. To construct PROJECT by contract in accordance, with plans and specifications prepared by CARLSBAD with assistance from CMWD and DISTRICT and approved by CMWD and DISTRICT, said plans being referred to as Improvement Plans for Rancho Santa Fe Road North, Phase 1, City of Carlsbad Drawing No. 368-2.

3. To advertise for construction bids after CARLSBAD has received written approval from CMWD and DISTRICT of plans, specifications and estimates.

4. To establish separate PROJECT accounts to accumulate charges for all costs to be paid for by CMWD and DISTRICT pursuant to this Agreement.

5. To receive from CMWD and DISTRICT designated PROJECT representative prior approval of all change orders, affecting CMWD and DISTRICT facilities, before implementation, except when necessary for the safety of motorists and/or pedestrians or for the protection of property.

6. Upon completion of PROJECT and all work incidental thereto, to furnish CMWD and DISTRICT with a detailed statement of the total actual costs of construction and services for PROJECT, including the costs of any contract claims which have been allowed to the construction contractor.

7. To designate a project Resident Engineer who shall represent CARLSBAD as the single point of contact for PROJECT administration.

8. To consult with CMWD and DISTRICT in resolution of any contract claims associated with PROJECT work.

9. To acquire and pay for all necessary rights-of-way for the road and waterline easements, to the satisfaction of DISTRICT, for those lines, including access roads required to be relocated in which the DISTRICT has senior rights.

10. To fund the costs of those recycled waterline facilities required to be relocated as a result of the Road realignment where the DISTRICT has senior rights as listed in Section I.A. above and as shown under CARLSBAD on Exhibit "B", attached hereto and made a part hereof. The faclilites relocation costs shall be based on the unit costs for the items as shown on the successful bidder's Bid Schedule. Said costs shall include providing personnel resources, design costs and any furnished materials, supplemental work, approved change orders and contract claims paid to the construction contractor, and the defense of all PROJECT related claims which may be filed by the contractor or portion of services attributed to such work applied in accordance with standard accounting procedures. The actual cost of services for PROJECT shall be determined after completion of all work and upon final accounting of costs.

11. To provide District with as-built drawings with any changes within 60 days of completion of the Project.

C. CMWD AGREES:

1. To fund the cost of upsizing DISTRICT's 12" recycled water pipeline to a 24" recycled water pipeline as shown under the CMWD column on Exhibit "B".

2. To enter into a seperate agreement with DISTRICT to address maintenance, operations and capacity rights for the recycled water pipeline.

C. DISTRICT AGREES:

1. To designate a single project representative authorized to act on behalf of DISTRICT in relation to contract change orders and overall PROJECT coordination. All final decisions that pertain to or affect any DISTRICT easements or facilities will be made soley by the DISTRICT except when necessary for the safety of motorists and/or pedestrians or for the protection of property. Where a decisions affects both DISTRICT easements or facilities and is necessary for the safety of motorists and/or pedestrians or to protect property, CARLSBAD and the DISTRICT shall agree on the final decision. All final decisions on the PROJECT that do not pertain to or affect any DISTRICT facilities, easements, or contributions will be made soley by CARLSBAD. Decisions that affect DISTRICT contributions will be made jointly by CARLSBAD and DISTRICT. DISTRICT shall respond in a timely manner in all cases requiring a decisions by DISTRICT. District shall be responsible for justified costs incurred by the contractor resulting from delays due to non responsiveness on the part of District.

2. To relinquish to CARLSBAD DISTRICT'S rights in the maintenance and operation of the construction zone within the boundaries of DISTRICT for the duration of construction and authorizes CARLSBAD to act as DISTRICT'S authorized agent to direct contractor for traffic control, signal timing, and other measures deemed necessary for construction and administration of the PROJECT.

3. To bear the actual cost for those portions of the recycled waterline and other facilities relocation's that are to be placed within the relocated ROAD. These facilities are shown under DISTRICT on Exhibit "B". Said costs of services shall include design, project management, and the cost of any furnished materials, supplemental work, change orders and contract claims paid to the construction contractor, and the defense of all project related claims which may be filed by the contractor or portion of services attributed to such work applied in accordance with standard accounting procedures. The actual cost of services for PROJECT shall be determined after completion of all work and upon final accounting of costs.

4. To be responsible for the operation and maintenance of recycled water facilities belonging to DISTRICT during the construction period of the PROJECT.

5. To pay CARLSBAD upon completion of all work and within twenty-five working days of receipt of a detailed statement made upon final accounting of costs, any amount over and above the aforementioned deposits and payments required to complete DISTRICT's financial obligation pursuant to this Agreement.

6. To provide all rights-of-way required for construction and necessary mitigation within DISTRICT jurisdiction.

7. To provide comments or approve PROJECT plans and specifications change orders affecting District work within ten working (10) days of submittal by CARLSBAD.

8. Within ten working (10) days of completion of the PROJECT and notification by CARLSBAD, DISTRICT shall inspect all work performed on the PROJECT and determine whether the work was completed in accordance with DISTRICT approved plans and specifications. If by the end of this ten (10) day period, DISTRICT has not notified CARLSBAD in writing through the City Engineer that the work materially varies from the approved plans, DISTRICT shall be deemed to have accepted the PROJECT in accordance with the approved plans and specifications.

9. To cooperate in obtaining required permits.

10. To expeditiously review and approve any required permits for construction of PROJECT within jurisdiction.

II. OWNERSHIP AND MAINTENANCE

A. ROAD IMPROVEMENTS

Upon completion of all work under this Agreement, ownership and title to materials, equipment, and appurtenances which are installed within CARLSBAD's right-of-way will automatically be vested in and maintained by CARLSBAD with the exception of materials, equipment, and appurtenances which are the responsibility of the DISTRICT.

B. RECYCLED WATER LINE EASEMENTS

Upon completion of all work under this Agreement, ownership and title to materials, equipment, and appurtenances which are installed within DISTRICT's easements will automatically be vested in and maintained by DISTRICT.

III. LIABILITY AND INDEMNIFICATION

Pursuant to Section 895.4 of the Government Code, CARLSBAD, CMWD and DISTRICT agree that each will assume the full liability imposed upon it or any of its officers, agents, or employees for injury caused by or arising out of a negligent or wrongful act or omission accruing in the performance of it's obligations under this agreement, and each party agrees to indemnify and hold harmless the other party for any loss, cost, or expense that may be imposed upon such other party by virtue of Sections 895.2 and 895.6 of the Government Code.

The indemnity provisions are not limited in any way by the extent of any policy of insurance currently in force and held by either party. All construction contracts for any project which spans the jurisdictional boundary between CARLSBAD, CMWD and DISTRICT shall include indemnity provisions and insurance provisions, whereby the contractor indemnities both CARLSBAD, CMWD and DISTRICT and adds all agencies as additional insured on Insurance Policy.

IV. NOTIFICATIONS

Unless otherwise specifically provided in this Agreement, all notices, demands, or other communications given hereunder will be in writing and will be deemed to have been duly delivered upon personal delivery or as of the second business day after mailing by United States mail, return receipt requested, postage prepared and addressed as follows:

If to DISTRICT:

William W. Rucker
General Manager
VALLECITOS WATER DISTRICT
201 Vallecitos de Oro
San Marcos, CA 92069

If to CARLSBAD and/or CMWD:

Lloyd Hubbs
Public Works Director
CITY OF CARLSBAD
1635 Faraday Avenue
Carlsbad, CA 92008

V. MODIFICATIONS

This Agreement may not be modified, amended, or otherwise changed unless by an amendment, in writing, executed by the parties hereto.

VI. TERMINATION

This Agreement shall terminate after all the street and water line improvements contemplated by this agreement have been constructed, after all payments required under this agreement have been made, and after all maintenance responsibilities for the respective street and water improvements have been assumed by the respective agencies in accordance with the terms of this agreement.

VII. COUNTERPARTS

This agreement may be executed by the CARLSBAD, CMWD and DISTRICT in separate counterparts, each of which when so executed and delivered shall be an original, but all such counterparts shall together constitute one and the same instrument

VIII. CHOICE OF LAW

This agreement shall be governed by, the laws of the State of California and venue shall be proper in the San Diego Superior Court, North County Branch or such other venue as provided by law.

IX. SEVERABILITY

If one or more clauses, sentences, paragraphs, provisions or terms of this agreement shall be held to be unlawful, invalid, or unenforceable, it is hereby agreed by the CARLSBAD, CMWD and DISTRICT that the remainder of this agreement shall not be affected hereby.

X. HEADINGS

The headings of articles and paragraphs of this agreement are for convenience only, and no presumption or implication of the intent of the parties as to the construction of this agreement shall be drawn therefrom.

XI. COMPLETE AGREEMENT

The foregoing constitutes the full and complete agreement of the parties. There are no oral understandings or agreements not set forth in writing herein.

///

///

///

///

IN WITNESS WHEREOF, this Agreement is executed by the CITY OF CARLSBAD pursuant to action taken by its City Council, by the Carlsbad Municipal Water District pursuant to action taken by its Board of Directors and by the Vallecitos Water District pursuant to action taken by its Board of Directors.

VALLECITOS WATER DISTRICT,
a County Water District

DALE MASON, President

DATE: _____

ATTEST:

WILLIAM W. RUCKER,
Board Secretary

VALLECITOS WATER DISTRICT
APPROVED AS TO FORM:

By: _____
JEFFREY G. SCOTT, District Counsel

CITY OF CARLSBAD,
a municipal corporation

CLAUDE A. LEWIS, Mayor

DATE: 2-19-04

ATTEST:

LORRAINE M. WOOD,
City Clerk

APPROVED AS TO FORM:
RONALD R. BALL
City Attorney

By _____
Deputy City Attorney
2/19/04

CARLSBAD MUNICIPAL WATER DISTRICT,
a municipal corporation

CLAUDE A. LEWIS, President

DATE: 2/19/04

ATTEST:

LORRAINE M. WOOD, Assistant Secretary

CARLSBAD MUNICIPAL WATER DISTRICT
APPROVED AS TO FORM:

By: _____
RON BALL, General Counsel
2/19/04

EXHIBIT "A"

Rancho Santa Fe Road Improvements

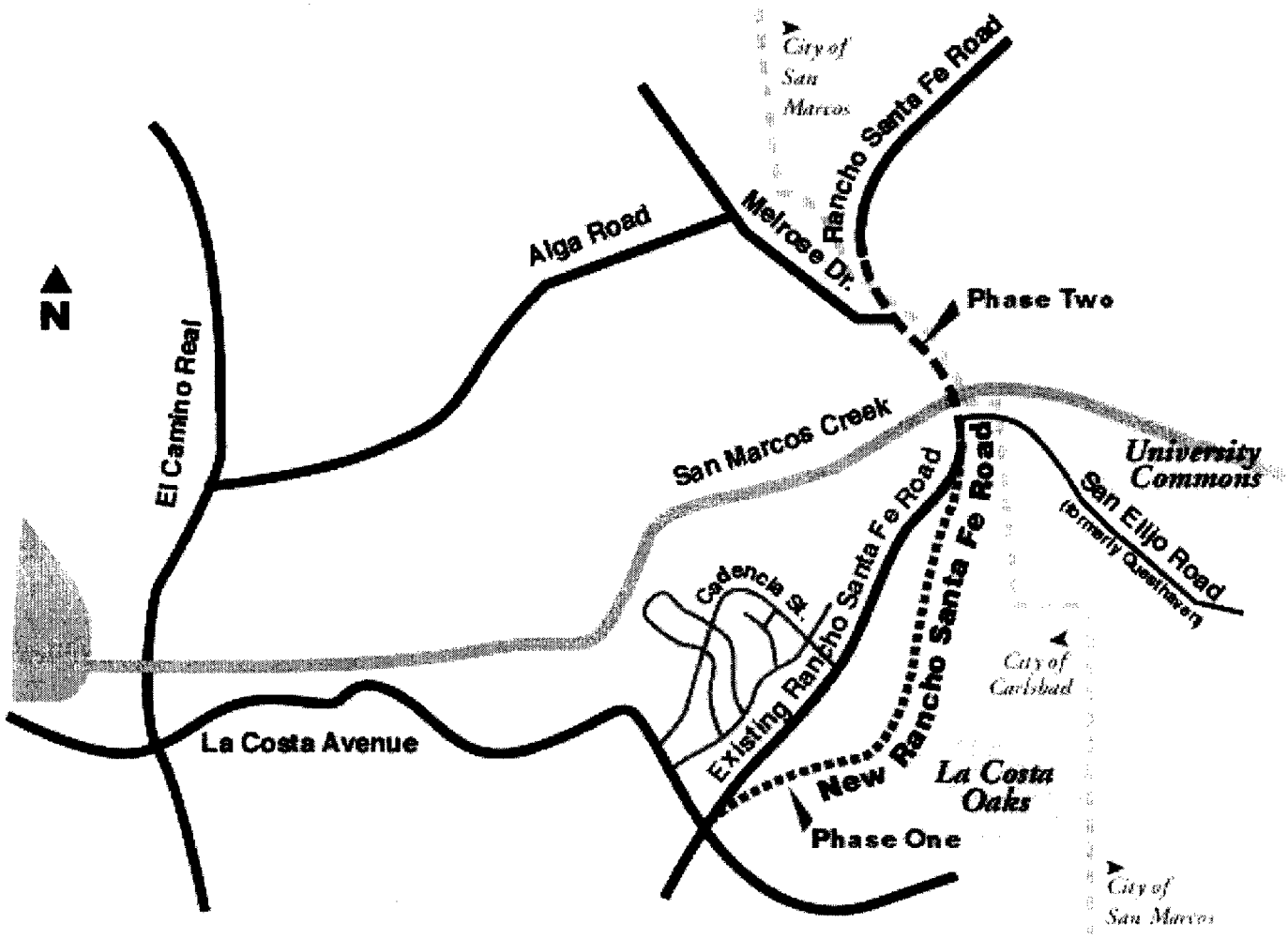


EXHIBIT "B" TO VWD AGREEMENT W/BID UNIT PRICES

RANCHO SANTA FE ROAD NORTH, PHASE 1

(3) **RECYCLED WATER AND POTABLE WATER IMPROVEMENTS (CMWD & DISTRICT)**

							CARLSBAD		CMWD		DISTRICT		VLC	
	Item No.	Description	Qty	Unit	Unit Price	Total	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
	C - 1	24" Class 250 DIP, Tylon Joint w/Poly-Wrap	1668	LF	$ 77.00	$128,436								
	C - 1a	12" Class 250 DIP	1668	LF	$ 45.00	$ 75,060	600	$ 27,000		$ -	1,068	$ 48,060		$ -
(1)	C - 1b	24" Class 250 DIP Upsized Pipe	1668	LF	$ 32.00	$ 53,376		$ -	1,668	$ 53,376		$ -		$ -
	C - 2	24" Class 250 DIP, Restrained Joint with Poly-Wrap	540	LF	$ 160.00	$ 86,400								
	C-2a	12" Class 250 DIP, Restrained Joint with Poly-Wrap	540	LF	$ 93.51	$ 50,495		$ -		$ -	540	$ 50,495		$ -
(1)	C-2b	24" Class 250 DIP, Restrained Joint with Poly-Wrap Upsized Pipe	540	LF	$ 66.49	$ 35,905		$ -	540	$ 35,905		$ -		$ -
(2)	C - 3	8" Recycled Water C 900 Class 150 PVC	34	LF	$ 61.00	$ 2,074		$ -		$ -		$ -	34	$ 2,074
(2)	C - 4	12" Potable Water Class 350 DIP, Tylon Joint w/Poly-Wrap including fittings	1067	LF	$ 45.00	$ 48,015		$ -		$ -		$ -	####	$ 48,015
(2)	C - 5	8" Potable water Class 350 DIP, Tylon Joint w/Poly-Wrap including Fittings	109	LF	$ 61.00	$ 6,649		$ -		$ -		$ -	109	$ 6,649
	C - 6	Piping, Valving, and Connection to Existing 12" Recycled Water Main at Approximate Sta. 96+20.	1	LS	$ 4,000.00	$ 4,000	1	$ 4,000		$ -		$ -		$ -
	C - 7	12" DIP Piping, Valving, and Connection to Existing 12" Recycled Water Main at Mahr Reservoir.	1	LS	$ 5,070.00	$ 5,070	1	$ 5,070		$ -		$ -		$ -
	C - 8	24" Butterfly Valve per CMWD Standard Drawing No. W-17.	5	EA	$ 5,900.00	$ 29,500								
	C - 8a	12" Resilient Wedge Gate Valve per VWD Standard Drawing No. W-14 & W-16	5	EA	$ 2,000.00	$ 10,000		$ -		$ -	5	$ 10,000		$ -
(1)	C - 8b	24" Butterfly Valve per CMWD Standard Drawing No. W-17 Upsize	5	EA	$ 3,900.00	$ 19,500		$ -	5	$ 19,500	-	$ -		$ -
(2)	C - 9	12" Resilient Wedge Gate Valve per VWD Standard Drawing No. W-14 & W-16	6	EA	$ 2,000.00	$ 12,000		$ -	-	$ -	5	$ 10,000	1	$ 2,000
(2)	C - 10	8" Resilient Wedge Gate valve per VWD Standard Drawing No. W14 and W16.	1	EA	$ 1,250.00	$ 1,250		$ -		$ -	-	$ -	1	$ 1,250
(2)	C - 11	2" Irrigation Service per VWD Standard Drawing No. W-7	5	EA	$ 2,500.00	$ 12,500		$ -		$ -	-	$ -	5	$ 12,500
(2)	C - 12	12" DI Flange Gate Valve	2	EA	$ 1,900.00	$ 3,800		$ -		$ -	-	$ -	2	$ 3,800
(2)	C -13	8" DI Flange Valve	1	EA	$ 1,250.00	$ 1,250		$ -		$ -	-	$ -	1	$ 1,250
	C - 14	1" Air Release and Vacuum Relief Valve per VWD Std. Dwg. No. W-1	1	EA	$ 2,200.00	$ 2,200		$ -		$ -	1	$ 2,200		$ -
(2)	C - 15	2" Blow-Off Assembly per VWD Standard Drawing No. W1.	7	EA	$ 1,600.00	$ 11,200		$ -	-	$ -	4	$ 6,400	3	$ 4,800
	C - 16	4" Air Release and Vacuum Relief Valve per Detail 6 on Sheet 78	4	EA	$ 7,800.00	$ 31,200		$ -	2	$ 15,600	2	$ 15,600		$ -
	C - 17	4" Blow0ff Assembly per Detail 4 Sheet 78	2	EA	$ 6,400.00	$ 12,800		$ -	1	$ 6,400	1	$ 6,400		$ -
	C - 18	12" Diameter Insulating Flange Kit	2	EA	$ 545.00	$ 1,090		$ -		$ -	2	$ 1,090		$ -
	C - 19	2 Wire, One Anode Test Station - Recycled Water	2	EA	$ 2,000.00	$ 4,000		$ -		$ -	2	$ 4,000		$ -
	C - 20	4 Wire Test Station	2	EA	$ 1,800.00	$ 3,600		$ -		$ -	2	$ 3,600		$ -
(2)	C - 21	2 Wire, One Anode Test Station - Potable Water	2	EA	$ 2,000.00	$ 4,000		$ -		$ -	-	$ -	2	$ 4,000
(4)	C - 22	Meter Vault	1	LS	$ 2,295.75	$ 2,296		$ -	1	$ 2,296		$ -		$ -
		Subtotal Construction				$413,330		$ 36,070		$ 133,076		$ 157,845		$ 86,338
		Contingency	10%			$ 41,333		$ 3,607		$ 13,308		$ 15,785		$ 8,634
		Total Construction				$454,663		$ 39,677		$ 146,384		$ 173,630		$ 94,972
		Inspection	5%			$ 22,733		$ 1,984		7,319		$ 8,681		$ 4,749
		Materials Testing	2%			$ 9,093		$ 794		2,928		$ 3,473		$ 1,899
		Contract Administration & Support	5%			$ 22,733		$ 1,984		7,319		$ 8,681		$ 4,749
		TOTAL COST				$509,222		$ 44,438		$ 163,950		$ 194,466		$ 106,368

Notes:

(1) CMWD pays for cost to upsize 12" RCW to 24" RCW.

(2) VLC = Villages of La Costa responsible for cost by separate Reimbursement Agreement. Shown for reference only.

(3) Items taken from RSF Rd., Phase 1, Bid Schedule C

(4) Meter Vault deleted from Construction (CO #6). Minor cost for Shop Dwg Preparation

Prepared By: HELMING ENGINEERING, INC.

Jan. 2, 2004

AGREEMENT NO. 23300

NEW LRP
ENCINA BASIN WATER RECLAMATION PROJECT – PHASES I AND II
LOCAL RESOURCES PROGRAM AGREEMENT
BETWEEN
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA,
SAN DIEGO COUNTY WATER AUTHORITY,
AND CARLSBAD MUNICIPAL WATER DISTRICT

AGREEMENT NO. 23300

NEW LRP
ENCINA BASIN WATER RECLAMATION PROJECT – PHASES I AND II
LOCAL RESOURCES PROGRAM AGREEMENT
BETWEEN
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA,
SAN DIEGO COUNTY WATER AUTHORITY,
AND CARLSBAD MUNICIPAL WATER DISTRICT

TABLE OF CONTENTS

NEW LRP
ENCINA BASIN WATER RECLAMATION PROJECT – PHASES I AND II
LOCAL RESOURCES PROGRAM (LRP) AGREEMENT
BETWEEN
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA,
SAN DIEGO COUNTY WATER AUTHORITY,
AND CARLSBAD MUNICIPAL WATER DISTRICT

THIS AGREEMENT is made and entered into as of March 28, 2000 by and among The Metropolitan Water District of Southern California (Metropolitan), San Diego County Water Authority (Authority), and Carlsbad Municipal Water District (Carlsbad). Metropolitan, Authority, and Carlsbad may be collectively referred to as "Parties" and individually as "Party".

RECITALS

A. There is now in effect a Local Resources Program Conversion Agreement (Conversion Agreement) dated July 1, 1999 by and among the Parties for the development and utilization of recycled water, which provides for the Encina Basin Water Reclamation Project – Phase I (Phase I Project);

B. Pursuant to the Conversion Agreement, the Phase I Project commenced operations in January 1993 and is capable of meeting an annual demand of 2,050 acre-feet of Recycled Water for non-potable landscape, agricultural, commercial, and industrial purposes;

C. Metropolitan's Board of Directors, at its June 9, 1998 meeting, established terms and conditions for the LRP and authorized staff to issue a Request for Proposals (RFP) targeting 53,000 acre-feet per year (AFY) of needed local resource production by the year 2010 from cost-effective projects that would help contribute to the region's overall water supply reliability;

D. In response to the RFP, Carlsbad submitted a project proposal for the 2,950 AFY Encina Basin Water Reclamation Project – Phase II (Phase II Project) that was competitively evaluated by a review committee and subsequently identified as one of 14 projects recommended for inclusion in the LRP to achieve the targeted production;

E. The Parties mutually agree to terminate the Conversion Agreement, referenced in Paragraph A above, effective July 1, 2000;

F. This Agreement combines both Phases I and II of the Encina Basin Water Reclamation Project;

G. Metropolitan was incorporated under the Metropolitan Water District Act (Act) for the purpose of developing, storing, and distributing water for domestic and municipal purposes;

H. The Act empowers Metropolitan to acquire water and water rights within or without the state; develop, store and transport water; provide, sell and deliver water at wholesale for municipal and domestic uses and purposes; set the rates for water; and acquire, construct, operate and maintain any and all works, facilities, improvements and property necessary or convenient to the exercise of the powers granted by the Act;

I. Authority, as a member public agency of Metropolitan under the Act, is a wholesale purchaser within its service area of water developed, stored, and distributed by Metropolitan;

J. Carlsbad is a member public agency of Authority and provides domestic and nondomestic water services entirely within Authority's service area;

K. Carlsbad is empowered under Section 71309 of the Water Code to enter into contracts necessary to carry out its powers and purposes;

L. Metropolitan's water supply and demand projections for its service area, including that encompassed by Authority, show that additional sources of supplemental water must be developed to meet future needs;

M. Metropolitan has determined to take all necessary steps to provide its service area with adequate and reliable supplies of high quality water in the years ahead in an environmentally and economically responsible way, including providing financial incentives to water recycling projects under its Local Resources Program (LRP);

N. Metropolitan and Authority have determined that it is mutually beneficial for local water projects originating in Authority's service area to be developed as a supplement to Metropolitan's imported water supplies in order to meet future water needs;

O. A significant amount of treated wastewater generated within Authority's service area is currently discharged to the ocean, which water when provided with tertiary treatment could be used for non-potable purposes;

P. Additional quantities of recycled water could be produced, distributed, and sold by Carlsbad by means of additional capital facilities to treat, distribute and use additional wastewater, thereby avoiding disposal thereof as a waste product and reducing the need for additional water that otherwise must be delivered from Metropolitan's imported water supply system for landscape irrigation purposes;

Q. Carlsbad is currently planning and desires to construct additional capital facilities collectively known as the Phase II Project, to treat and distribute, for beneficial use, additional treated wastewater, which will minimize present and future disposal of wastewater as a waste product from Carlsbad, in a manner cost-effective for its customers;

R. Metropolitan, in accordance with its LRP, desires to assist Carlsbad in the cost of treating and distributing recycled water for landscape irrigation purposes;

S. Carlsbad desires to comply with the provisions of Metropolitan's LRP in return for Metropolitan's financial assistance for the Project;

T. Metropolitan desires to assist in increasing production and distribution of recycled water by providing financial incentives to Carlsbad, through Authority, for implementation of the Project.

U. Authority desires to participate in and affirmatively supports the Project by transferring to Carlsbad the financial incentives that it receives from Metropolitan;

V. The Parties believe that treatment and distribution of recycled water from the Project will benefit the local community within Carlsbad and the region served by Metropolitan;

W. The Project, when fully developed, is estimated as being capable of delivering 5,000 acre-feet per year of recycled water by treating secondary wastewater and distributing recycled water for landscape irrigation purposes.

NOW, THEREFORE, in consideration of the promises and covenants hereinafter set forth, the Parties do agree as follows:

Section 1: Definitions

The following words and terms, unless otherwise expressly defined in their context, shall be defined to mean:

1.1: "Allowable Yield" shall mean the amount of Recycled Water that is delivered to End Users by Carlsbad from the Project in any given Fiscal Year and eligible to receive Metropolitan's financial assistance. Allowable Yield, measured in acre-feet, shall not exceed Ultimate Yield and shall exclude any Recycled Water Metropolitan reasonably determines will not reduce Authority's or Carlsbad's demand for Metropolitan's imported water.

1.2: "End User" shall mean each user that purchases Recycled Water furnished by the Project.

1.3: "LRP Contribution" shall mean the financial contribution in dollars per acre-foot Metropolitan pays for Allowable Yield to Carlsbad for monthly billing purposes as outlined in Exhibit B, incorporated herein by this reference. The LRP Contribution shall commence in Fiscal Year 2000-2001 and is limited to the Allowable Yield tabulated in Exhibit B.

1.4: "Fiscal Year" shall mean a Metropolitan Fiscal Year that begins on July 1 and ends on June 30.

1.5: "Project" shall mean the "Encina Basin Water Reclamation Project – Phases I and II" being developed by Carlsbad, as described in Exhibit A attached hereto and incorporated herein by this reference, consisting of existing facilities and additional capital facilities including treatment and distribution facilities capable of producing the Allowable Yield. Carlsbad shall notify Metropolitan prior to making any changes to the Project that requires new environmental documentation other than an addendum to the existing environmental documentation. After reviewing the proposed change and associated environmental documentation, Metropolitan shall inform Authority and Carlsbad of Metropolitan's decision whether or not to include the change to this Agreement.

1.6: "Ultimate Yield" is established as 5,000 AFY and represents the sum of Phase I Ultimate Yield (2,050 AFY) and Phase II Ultimate Yield (2,950 AFY). Ultimate Yield is subject to the reduction provisions outlined in Exhibit C, incorporated herein by this reference.

1.7: "Recycled Water" shall mean treated wastewater, which subject to regulatory requirements, is suitable for beneficial uses.

Section 2: Warranties

2.1 Carlsbad, by virtue of its ownership of the Project, warrants that it has a firm and adequate source of Recycled Water to operate the Project;

2.2: Carlsbad warrants that it is able and has a right to distribute and sell Allowable Yield produced from the Project.

2.3: Carlsbad warrants that it does not discriminate against employees or against any applicant for employment because of ethnic group identification, religion, age, sex, color, national origin, or physical or mental disability and further warrants that it requires all contractors and consultants performing work on the Project to comply with all laws and regulations prohibiting discrimination against employees or against any applicant for employment because of ethnic group identification, religion, age, sex, color, national origin, or physical or mental disability.

2.4: Carlsbad warrants that it has or will comply with the provisions of the California Environmental Quality Act for each and all components of the Project facilities.

Section 3: Ownership and Responsibilities

3.1: Carlsbad shall be the sole owner of the Project facilities. Metropolitan and Authority have no ownership right, title, security interest or other interest in the Project facilities.

3.2: Carlsbad shall be solely responsible for all design, environmental compliance, right-of-way acquisitions, permits, construction, and cost of the Project and all modifications thereof.

3.3: Carlsbad shall be solely responsible for operating and maintaining the Project, in accordance with all applicable local, state, and federal laws. Metropolitan and Authority shall have no rights, duties or responsibilities for operation and maintenance of the Project.

3.4: Carlsbad shall install, operate and maintain metering devices for the purpose of measuring the quantity of Allowable Yield delivered to each End User. Carlsbad shall also account for and distinguish between Allowable Yield produced under the LRP agreement for Phases I and II.

3.5: Carlsbad shall, during the term of this Agreement, use its best efforts to operate Project facilities to maximize Allowable Yield on a sustained basis.

3.6: Authority and Carlsbad shall assist Metropolitan in its effort to forecast future Project production.

3.7: Carlsbad shall notify and provide Metropolitan with a copy of relevant agreements if Carlsbad decides to convey water using the Project facilities to any party that is not an End User.

Section 4: Billing Process

4.1: Metropolitan shall pay Carlsbad, through Authority, the LRP Contribution specified in Exhibit B for Allowable Yield. Unless otherwise approved in writing by Metropolitan, no payment under this agreement shall be made by Metropolitan for groundwater, surface water or potable water deliveries to supplement the Recycled Water system.

4.2: Beginning on July 1, 2018, Allowable Yield shall exclude the first 2,050 AFY of Recycled Water produced by the Project.

4.3: Carlsbad shall invoice Metropolitan monthly for the LRP Contribution based upon the Allowable Yield billed to the End Users during the previous month. Metropolitan shall pay Carlsbad for invoiced LRP Contribution pursuant to Sections 4.1 and 4.5 by means of a credit included on the next water service invoice issued to Authority.

4.4: Upon receiving the Metropolitan invoice, Authority shall include the full amount of the LRP Contribution for the Allowable Yield received from Metropolitan as a credit on its next water service invoice to Carlsbad.

4.5: Unless otherwise provided for in this Agreement, all invoicing, billing, and crediting processes shall be in accordance with the rules and regulations established from time to time by Metropolitan as reflected in Metropolitan's Administrative Code.

Section 5: Record Keeping and Audit

5.1: Carlsbad shall establish and maintain separate accounting records of Project production and Allowable Yield for Phases I and II. In addition, Carlsbad shall collect and retain records of the total annual amount of water conveyed outside of Carlsbad's service area using Project facilities. Accounting for the Project shall utilize generally accepted accounting practices and be consistent with the terms of this Agreement.

5.2: Carlsbad shall collect and make available to Metropolitan upon request, Project production and Allowable Yield data for each Fiscal Year of Project operation and retain records of measurements taken by meters installed pursuant to Section 3.4. If upon administrative review of previously submitted Allowable Yield data is found to be incorrect, an adjustment for over- or underpayment of Allowable Yield for each applicable Fiscal Year shall be paid by Metropolitan or Carlsbad within one year of determination of actual Allowable Yield. Disputes regarding such administrative review shall be resolved by formal audit.

5.3: Metropolitan shall have the right to audit Project production and Allowable Yield determination relevant to the terms of this Agreement for a period of three Fiscal Years following termination of this Agreement. Metropolitan may elect to have such audits conducted by its staff or by others, including independent accountants or engineers, as designated by Metropolitan. Carlsbad shall make available for inspection to Metropolitan or its designee, upon 30 days advance notice, all records, books and other documents related to the determination of Allowable Yield. Based on the results of any independent audit, an adjustment for over- or under payment of Allowable Yield for each applicable Fiscal Year shall be paid by Metropolitan or Carlsbad within one year of determination after such adjustment.

5.4: Carlsbad shall keep Project production and Allowable Yield for at least five years following the end of each Fiscal Year.

5.5: By October 1st of each Fiscal Year, Carlsbad shall provide Metropolitan with a list of Phase I and Phase II users and the respective quantity of Recycled Water delivered to each user for the previous Fiscal Year.

Section 6: Term and Amendments

6.1: The Agreement shall commence on the date first herein written and terminate on June 30, 2019, subject to the performance provisions outlined in Exhibit C. The audit provisions shall remain in effect three full Fiscal Years after the termination of the Agreement.

6.2: This Agreement may be amended at any time by the written mutual agreement of the Parties.

Section 7: Hold Harmless and Liability

Carlsbad agrees at its sole cost and expense to indemnify, defend, and hold harmless Metropolitan and Authority, their Boards of Directors, officers, agents, and employees from any claim and any and all liability, including but not limited to, any claims for injury or death to any person, or damage to property for any act or omission or any liability due to water quality which may arise out of Carlsbad's approval of, and subsequent construction, operation, or ownership of the Project including the sale of Project water. Such indemnity shall include all loss related to any claim made, whether or not a court action is filed, and shall include attorney fees, administrative and overhead costs, engineering and consulting fees, and all other costs related to or arising out of such claim of liability.

Section 8: Notice

Any notice, payment, or instrument required or permitted to be given hereunder shall be deemed received upon personal delivery or 24 hours after deposit in any United States post office, first class postage prepaid and addressed to the Party for whom intended, as follows:

If to Metropolitan:

The Metropolitan Water District of Southern California
Post Office Box 54153
Los Angeles, California 90054-0153

Attention: General Manager

If to Authority:

San Diego County Water Authority
3211 Fifth Avenue
San Diego, California 92103-5718

Attention: General Manager

If to Carlsbad:

Carlsbad Municipal Water District
5950 El Camino Real
Carlsbad, California 92008-8893

Attention: Deputy City Engineer

Any Party may change such address by notice given to each of the other Parties as provided in this section.

Section 9: Successors and Assigns

This Agreement shall inure to the benefit of and be binding upon the successors and assigns of the Parties hereto. This Agreement and any portion thereof shall not be assigned or transferred to any entity not an original Party to this Agreement, nor shall any of the duties be delegated, without the express written consent of all Parties. Any attempt to assign or delegate this Agreement or any of the obligations or benefits of this Agreement without the express written consent of all Parties shall be void and of no force or effect.

Section 10: Severability

The partial or total invalidity of one or more sections of this Agreement shall not affect the validity of this Agreement.

Section 11: Integration

This Agreement comprises the entire integrated understanding between the Parties concerning the Project, and supersedes all prior negotiations, representations, or agreements.

Section 12: Governing Law

The law governing this Agreement shall be the laws of the state of California and the venue of any action brought hereunder shall be in Los Angeles County, California.

///
///
///
///
///
///
///
///
///

IN WITNESS WHEREOF, the parties hereto have executed this Agreement effective as of the date first hereinabove written.

APPROVED AS TO FORM:

N. Gregory Taylor
General Counsel

By: _____
Deputy General Counsel

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Ronald R. Gastelum
General Manager

By: _____
Stephen N. Arakawa, Acting Manager
Water Resources Management Group

APPROVED AS TO FORM:

By: _____
General Counsel

SAN DIEGO COUNTY WATER AUTHORITY

By: _____
Director of Water Resources

APPROVED AS TO FORM:

By: _____
General Counsel

CARLSBAD MUNICIPAL WATER DISTRICT

By: _____
President of the Board

o:\clustr10\mmshared\contract\agree\23300

EXHIBIT A

The Encina Basin Water Reclamation Project – Phases I and II

Project Description

Overview:

The Encina Basin Water Reclamation Project – Phases I and II (Project) is owned and operated by the Carlsbad Municipal Water District (Carlsbad). Under the Project, approximately 5,000 acre-feet per year (AFY) is delivered to Carlsbad Recycled Water customers for landscape, agricultural, commercial and industrial purposes. The Project is located entirely within Carlsbad's service area immediately south of Palomar Airport Road and west of El Camino Real (see Figure 1).

Sources of Recycled Water

1. Meadowlark Water Reclamation Facility

Under Phase I, the Project currently receives Recycled Water from two external sources. The majority of the Project's water needs are supplied by the Meadowlark Water Reclamation Facility (Meadowlark), which is owned and operated by Vallecitos Water District (Vallecitos). Meadowlark provides primary, secondary and tertiary treatment to wastewater and has a current capacity of about 2 million gallons per day. Recycled Water from Meadowlark is delivered to the Project through Vallecitos' fail-safe pipeline. Recycled Water in the fail-safe pipeline which is not used by the Project is delivered to the Encina Water Pollution Control Facility (Encina) and then discharged to the ocean. Carlsbad has entered into an agreement with Vallecitos to purchase up to 2,040 AFY from Meadowlark. Meadowlark, the Mahr Reservoir and Vallecitos' fail-safe pipeline are pre-existing and not part of the Project.

2. Gafner Water Reclamation Plant

The second source of Phase I Recycled Water is the Gafner Water Reclamation Plant (Gafner), which is owned and operated by Leucadia County Water District (Leucadia). Gafner provides primary, secondary and tertiary treatment and has a current capacity of about 0.75 million gallons per day. Raw wastewater can also be sent to Encina via a separate pipeline from Gafner. At Leucadia's discretion, secondary treated wastewater can be pumped back from Encina to Gafner for tertiary treatment. Carlsbad has entered into a take-or-pay agreement with Leucadia to purchase a minimum of 394 AFY from Gafner for Recycled Water deliveries supplied only to La Costa South Golf Course. Gafner and Encina are pre-existing and not part of the Project.

3. Carlsbad Water Recycling Facility

Included in the development of Phase II facilities is construction of the proposed 5 million gallons per day Carlsbad Water Recycling Facility (CWRF). CWRF will provide tertiary treatment of secondary effluent from Encina and serve Recycled Water to the Project. Additional facilities may include microfiltration and reverse osmosis to reduce total dissolved solids levels in Recycled Water.

Project Facilities

Phase I

Phase I of the Project consists of a distribution system, conversion of two potable water reservoirs to Recycled Water reservoirs and installation of potable water pipelines to replace pipelines for Recycled Water use. The distribution system includes about six miles of Recycled Water pipeline, pumping facilities, and a one-mile pipeline to replace the existing potable water pipeline that will be converted for Recycled Water use. Both the La Costa North and South Golf Course receive Recycled Water from the Project via existing, non-project pipelines. In addition, the Project includes capital improvements to Meadowlark including modifications to the effluent pump station, construction of a diversion structure, and installation of electrical and instrumentation equipment.

Phase II

Phase II of the Project will involve construction of the 5 million gallons per day CWRF, extension of the existing Recycled Water distribution system by approximately 75,000 feet to serve new users, construction of a new pump station, and conversion of the existing Mahr Reservoir for Recycled Water storage. Although capital improvements to convert the existing Mahr Reservoir from potable to Recycled Water use are included in the Project, the Mahr Reservoir is considered pre-existing and not part of the Project.

End Users

Recycled Water from the Project will be produced for non-potable landscape and agricultural irrigation, and commercial and industrial purposes within Carlsbad's service area.

Points of Connection

Project facilities shall terminate at the points of connection to the Project's sources of supply, brine disposal facilities, Mahr Reservoir, the potable distribution systems, sewer systems, storm drains, groundwater extraction systems, Vallecitos' fail-safe pipeline, and meter connections to End Users.

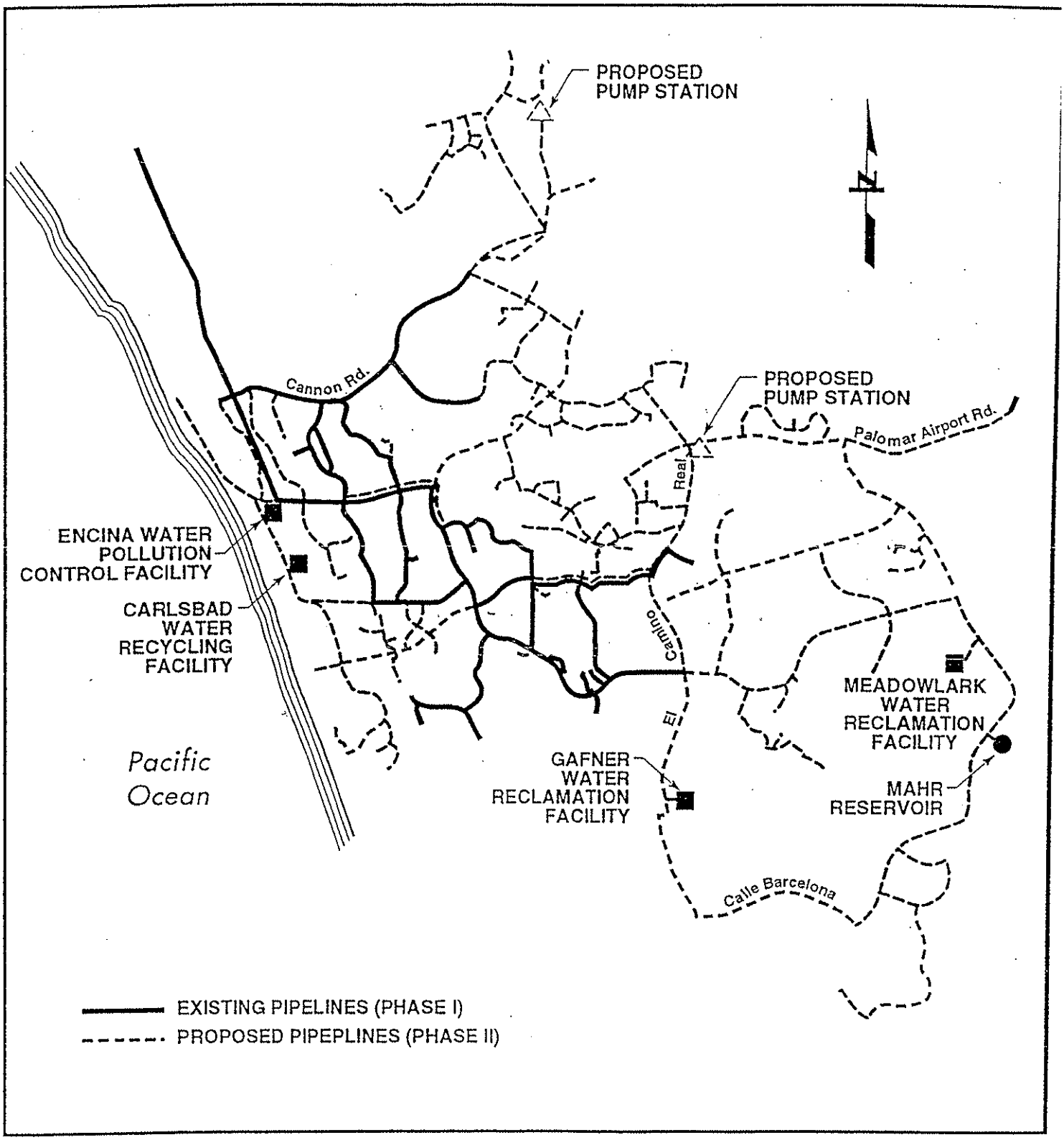


Figure 1

ENCINA BASIN WATER RECLAMATION PROJECT
PHASE I & II

EXHIBIT B

LRP CONTRIBUTION SCHEDULE

Fiscal Year	LRP Contribution ($/AF)	Maximum Annual Allowable Yield* (AF)
2000-01	210	2,250
2001-02	210	2,550
2002-03	210	3,050
2003-04	210	3,450
2004-05	200	3,850
2005-06	200	4,250
2006-07	200	4,650
2007-08	200	4,950
2008-09	200	5,000
2009-10	139	5,000
2010-11	100	5,000
2011-12	100	5,000
2012-13	100	5,000
2013-14	100	5,000
2014-15	100	5,000
2015-16	100	5,000
2016-17	100	5,000
2017-18	100	4,150**
2018-19	100	2,950***

* - Subject to reduction provisions outlined in Exhibit C.

** - Reduction attributable to eligible deliveries from Phase I Project through 1/31/2018.

*** - Ultimate Yield less Phase I Project Yield per Section 4.2 of this Agreement.

EXHIBIT C

PERFORMANCE PROVISIONS

1. The following performance provisions apply:

   a. The Agreement will terminate if construction of Phase II facilities has not commenced by April 1, 2002. If this Agreement is terminated under this provision, the Conversion Agreement shall be restored to full force and effect. There is no established appeal process for this outcome.

   b. The Agreement will terminate if Project production is not delivered from the proposed 5 million gallons per day CWRF by April 1, 2006. If this Agreement is terminated under this provision, the Conversion Agreement shall be restored to full force and effect. The Project sponsor(s) may appeal this decision to Metropolitan's Board of Directors.

   c. If Phase II production from the CWRF during Fiscal Years 2004-05 through 2007-08 does not reach the target yield of 1,092 acre-feet (AF), Metropolitan will reduce the Allowable Yield outlined in Exhibit B. The reduction shall be one-half the shortfall between the targeted yield and the highest Phase II production in that period. For example, the Phase II Ultimate Yield of the Project for the following performance will be revised from 2,950 to 2,879 AFY for Scenario 1 beginning in Fiscal Year 2008-09. There would be no adjustment under Scenario 2.

	Scenario 1	Scenario 2
Fiscal Year	Phase 2 (AFY)	Phase 2 (AFY)
2004-05	700	700
2005-06	850	850
2006-07	900	1,300
2007-08	950	950

Scenario 1: FY 2008-09 Allowable Yield = 5,000 AF
Shortfall = 0.5 x (1,092 – 950) = 71 AF

The Allowable Yield for Fiscal Years 2008-09 through 2018-19 outlined in Exhibit B, will be reduced by 71 AF.

Scenario 2: Since Phase II production is greater than 1,092 AF in Fiscal Year 2006-07, no adjustment is required.

d. If Phase II production from the CWRF during Fiscal Years 2008-09 through 2011-12 does not reach the target yield of 1,858 AF (or revised Allowable Yield if applicable), Metropolitan will reduce the Allowable Yield (or revised Allowable Yield if applicable) outlined in Exhibit B. The reduction shall be one-half the shortfall between the targeted yield and the highest Phase II production in that period.

	Scenario 1	Scenario 2
Fiscal Year	Phase 2 (AFY)	Phase 2 (AFY)
2008-09	1,500	1,500
2009-10	1,550	1,600
2010-11	1,700	1,350
2011-12	1,200	1,400

Scenario 1: FY 2012-13 Allowable Yield (Revised) = 4,929 AF
Shortfall = 0.5 x (1,858 – 1,700) = 79 AF

The Allowable Yield for Fiscal Years 2012-13 through 2018-19 outlined in Exhibit B, will be reduced by 79 AF.

Scenario 2: FY 2012-13 Allowable Yield = 5,000 AF
Shortfall = 0.5 x (1,858 – 1,600) = 129 AF

The Allowable Yield for Fiscal Years 2012-13 through 2018-19 outlined in Exhibit B, will be reduced by 129 AF.

e. If Phase II production from the CWRF during Fiscal Years 2012-13 through 2015-16 does not reach the target yield of 2,212 AF (or revised Allowable Yield if applicable), Metropolitan will reduce the Allowable Yield (or revised Allowable Yield if applicable) outlined in Exhibit B. The reduction shall be one-half the shortfall between the targeted yield and the highest Phase II production in that period. The adjustment will be made using the same methodology shown in the above examples.

2. If Phase II production from the CWRF reaches 2,950 AF in any one Fiscal Year, there will be no adjustment to the Allowable Yield thereafter.

o:\clustr10\mmshared\contract\agree\23300

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Office of the General Manager

May 15, 2001

Mr. Robert Greaney
General Manager
Carlsbad Municipal Water District
5950 El Camino Real
Carlsbad, California 92008

Dear Mr. Greaney:

Commencement of Construction for Encina Basin Water Reclamation Program – Phase 2

On March 28, 2000, Metropolitan, San Diego County Water Authority, and Carlsbad Municipal Water District entered into a Local Resources Program Agreement for development of the Encina Basin Water Reclamation Program Phase 1 and 2 (Agreement No. 23300).

This is a reminder that our agreement incorporates several performance targets that result in withdrawal or adjustment of financial commitments if the project fails to meet provisions outlined in Exhibit C. The first performance provision pertains to project development and calls for agreement termination if construction has not commenced before April 1, 2002. In the event of agreement termination under this performance provision, the Phase 1 Conversion Agreement (Agreement No. 22152) would be restored to full force and effect. Unlike other performance provisions, there is no established appeal process for this outcome.

We look forward to working with your staff in developing your project. For coordination of a field visit to verify commencement of project construction, please contact Mr. Andy Hui at (213) 217-6557.

Very truly yours,

Andrew Sienkiewich
Manager, Resource Procurement

AMH:cmk
o:\clustr10\shared\corres\encinacommenceletter.doc

cc: Ms. Maureen Stapleton, San Diego County Water Authority
Ms. Cheryl Munoz, San Diego County Water Authority
Mr. William Plummer, Carlsbad Municipal Water District